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Standardizing Parts for Fixture Track Systems

By W. F. SANDMANN

The problem of standardizing track fixtures—Usefulness in progressive multiple drilling, boring, tapping and reaming —The predominating type of fixture —Methods of indexing

IN THEIR efforts to avoid the use of special machinery manufacturing executives are adopting, where possible, the fixture track system. The system enables them to secure high production with the use of only standard machine tools. The first cost of special machinery is not only high, but if a slight change is made in the design of the part manufactured it may necessitate the reconstruction of the whole machine or even cause it to be discarded entirely. With the fixture track system a change in the design of the manufactured product can scarcely cause any more expense than the construction of new indexing boxes or cradles for the fixtures.

The problem of standardizing the track fixtures and also making them partly interchangeable has caused much close study to be given the subject. Of course there is no such thing as standardizing the cradle or indexing box, for each of them must necessarily be designed for the individual part it is to hold. But such parts as end trunnions and indexing devices can be so constructed that they can be used in connection with any cradle or box.

A number of prominent plants are using track systems that are very similar in general design and which can, with slight alterations, be made to accommodate a large variety of work. As the track system is at its height of usefulness in progressive multiple drilling, boring, tapping and reaming operations the most careful attention has been given it in plants having quantity production of parts requiring these operations.

Advantages of Track Systems

The flexibility of the system can be readily seen, for production can be increased by merely adding more fixtures to the lineup of machines and it can be decreased by removing fixtures. The maximum number of fixtures that can be used is one for each machine tool in the lineup and one extra for loading and unloading purposes. When a lineup of machines is using its full complement of fixtures the rate of production of the part being machined is governed by the slowest operation in the line, one fixture being ready to unload its completed part every time the machines in the lineup have completed one operation.

The predominating type of fixture is that shown in Fig. 1. The dotted portions at *N* represent the cradle or indexing box which is specially designed to hold the part that is to be machined while in the fixture. The indexing of the cradle for the various operations that are to be performed is by means of the pilot wheel *B*. If the cradle *N* is accurately designed as to balance, no trouble will be experienced in turning it to the various positions. The two end trunnions *A* form the bearings for indexing the cradle, which is held in the trunnions by the bearing caps *O*. The index pin *D* locates the cradle in the various positions in which it is turned by entering the bushings *U* and is operated by the lever *C* which is fulcrumed at *E*. The index pin at *M* is used when extreme rigidity is required at any indexing point and enters a set of bushings similar to those at *U*. The tie rods *L* hold the two end trunnions together and are secured by nuts at each end. These tie rods are shouldered where they enter the trunnions so that the trunnions are spaced correctly.

Construction of Track Fixtures

When the cradle of the fixture is to be replaced by another one of different design it is only necessary to remove the caps *O* and lift the cradle from its bearings. If the new cradle is of different length, new tie rods *L* will be required.

The fixture is moved along the track *P* on four wheels. The two wheels on the one side of the fixture are of the V-type as shown in section at *G*, and the two on the other side are flat as shown at *H*. The V-wheels guide the fixture, and the flat wheels serve to keep their side at the correct level and at the same time make it possible for the gage of the track *P* to vary without affecting the movement of the fixture or cause its derailment. All wheels are generally equipped with a good grade of roller bearings for considerable thrust must be absorbed while the various operations are being performed.

The brushes *J* at each wheel are for the purpose of

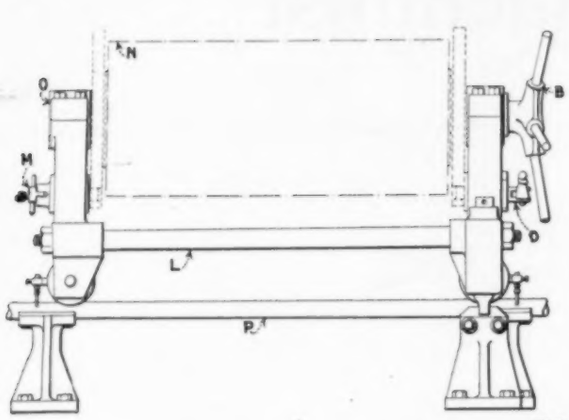


FIG 1

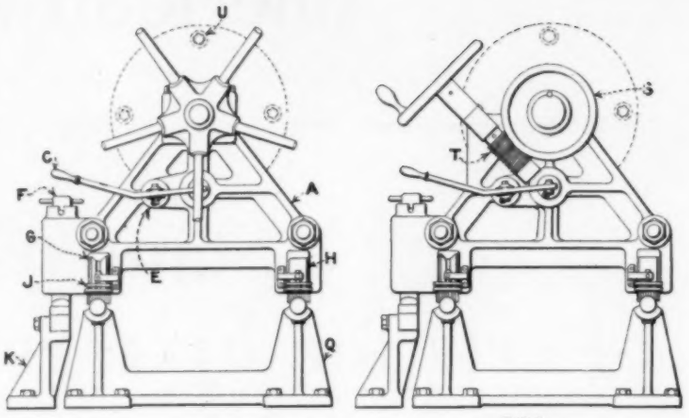


FIG 2

FIG. 1—TRUNNION JIG WITH PILOT HUB INDEX. FIG. 2—END VIEW OF TRUNNION JIG WITH WORM INDEX

keeping the track clear of shavings and dirt so that the fixture will move smoothly and be level. *F* is the locating pin which locates in the block *K* to line the fixture up in the proper position under each machine where an operation is to be performed. The cross-ties *Q* are placed at suitable intervals to support the track and elevate it over the bases of the various machines.

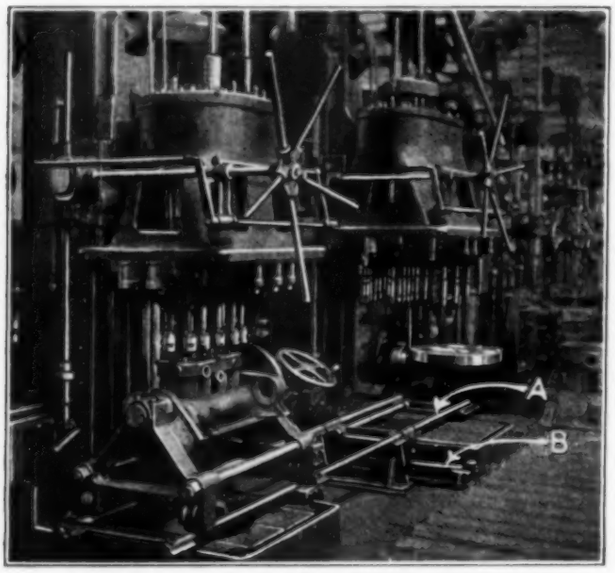


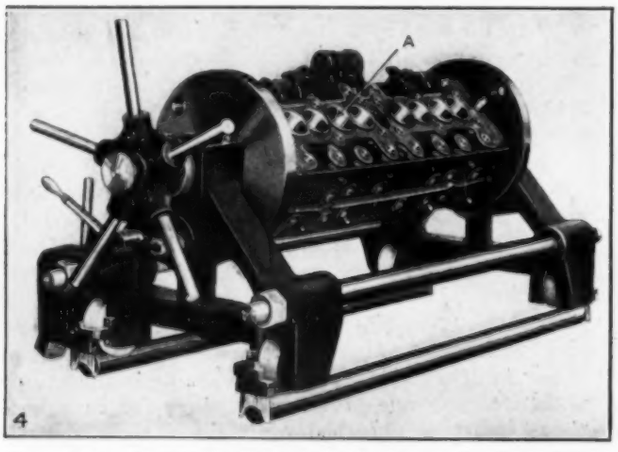
FIG. 3—SHORT TRACK SYSTEM UNDER TWO MULTIPLE DRILLING MACHINES

Fig. 2 shows another end for the same type of fixture as illustrated in Fig. 1, the only difference being that the indexing is done by means of a worm *T* and wormwheel *S*, preferably double lead so as to secure quick indexing. The construction is used when the cradle for some reason is designed out of balance or when the cradle and work are too heavy and unwieldy to be safely turned by the plain pilot wheel.

An Example of Short Track System

In Fig. 3 is illustrated a short track system that extends under the heads of two multiple drilling machines. The fixture in use is such as previously described with the worm and wormwheel for indexing purposes. This track system is used for tapping a cylinder block. The top or stud holes are tapped by the first machine and then the fixture is moved to the second machine, indexed 180 deg. and the holes in the pan flange and for the screws for the bearing caps tapped. The last operation is divided into two parts. The section of the track shown at *A* is a rolling section that moves on the sub-track *B*. By the arrangement the pan flange holes are tapped under the rear of the head of the machine, and then the fixture and rolling section are moved forward and the bearing cap holes tapped. The cradle is then indexed back to its original position and the cylinder block unclamped and removed.

A fixture with an indexing box for a valve-in-head



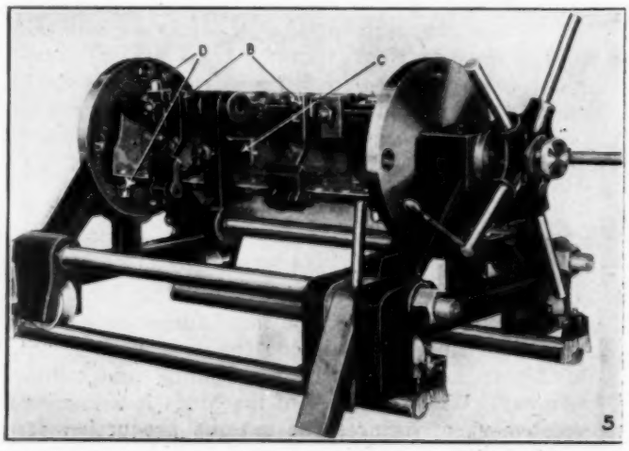


FIG. 4—FIXTURE FOR A VALVE-IN-HEAD TYPE OF CYLINDER HEAD. FIG. 5—LOADING SIDE OF FIXTURE FOR CYLINDER HEAD

type of cylinder head is shown in Fig. 4. The end trunnions and indexing device are the same as shown in Fig. 1. A cylinder head of this type contains an extraordinarily large number of holes to be drilled, reamed and counterbored and a great many of the drill and reamer bushings can be seen. The large bushings at *A* are to guide the pilots of the tools that face the valve seats in the head.

Another view of the same fixture illustrated in Fig. 5 shows the side from which the cylinder head is loaded into the box. It will be noted that five clamps are used to hold the head in place and support the sides of the box, the two at *B* each containing two drill bushings for holes that are to be drilled at an angle. The clamp *C* contains the equalizer that locates the cylinder head lengthwise. The track locater on the fixture is a little different than the one shown in Fig. 1 being simply a bar that falls in a slot that is located in a casting fastened to the floor beside the track at the correct point. The pins *D* are locaters for plates that carry additional drill bushings and which are suspended from the heads of the multiple drilling machines.

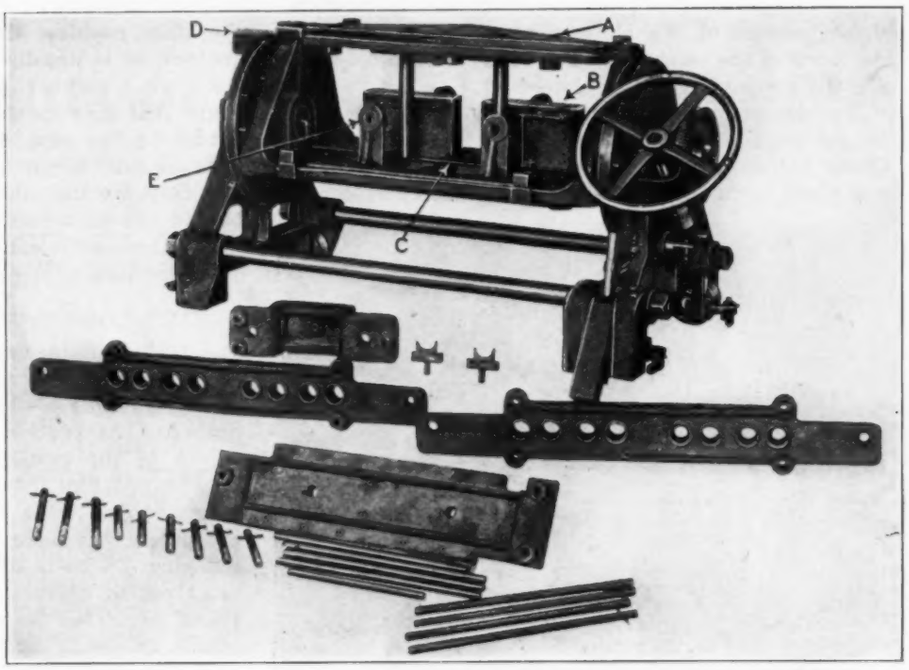


FIG. 6—FIXTURE EQUIPPED WITH THE WORM TYPE OF INDEXING DEVICE

A fixture that is equipped with the worm type of indexing device is shown in Fig. 6. The cradle of the fixture is designed to hold a very heavy crankcase. In this particular crankcase it is necessary to line ream the valve lifter guide holes, and in order to maintain the desired accuracy the line reamers must be piloted at both top and bottom. The plate *A* is suspended from the head of the straightline driller that does the line reaming and the reamers are guided by bushings in the plate, come on through the work and are piloted at the bottom in revolving pilot bushings *B*. The bushings revolve on ball thrust bearings that run in oil. The oil is supplied through the piping *C* from the tank at the end of the case at *D*.

The lugs containing bushings at *E* are for receiving plates containing drill bushings that are suspended from the heads of the multiple drilling machines. The plates are equipped with dowels that locate the plates by entering the bushings *E*. Below the fixture are

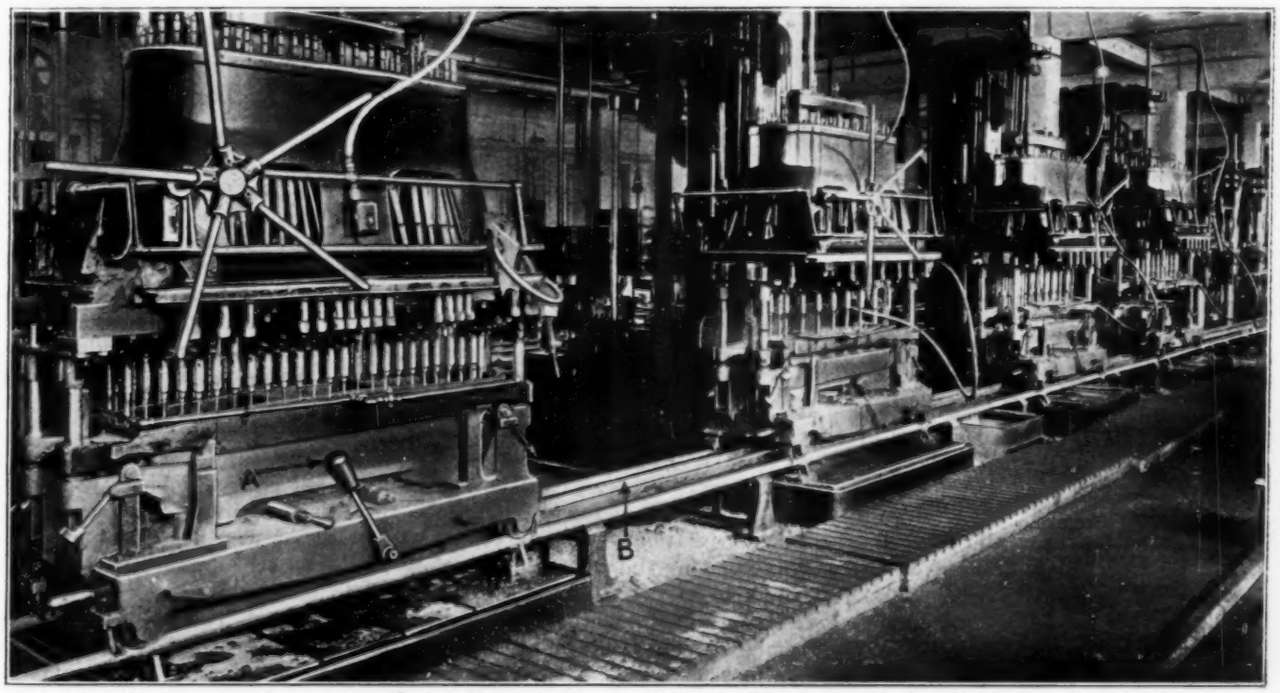


FIG. 7—LINE-UP OF MACHINES USING A FIXTURE TRACK SYSTEM

shown several of the plates that are suspended from the heads of the machines. The rods shown beside them are the supports for the plates.

An idea of the way machines are lined up for a fixture track system is illustrated in Fig. 7, which also shows plates carrying the drill and reamer bushings suspended from the heads of the machines and locating

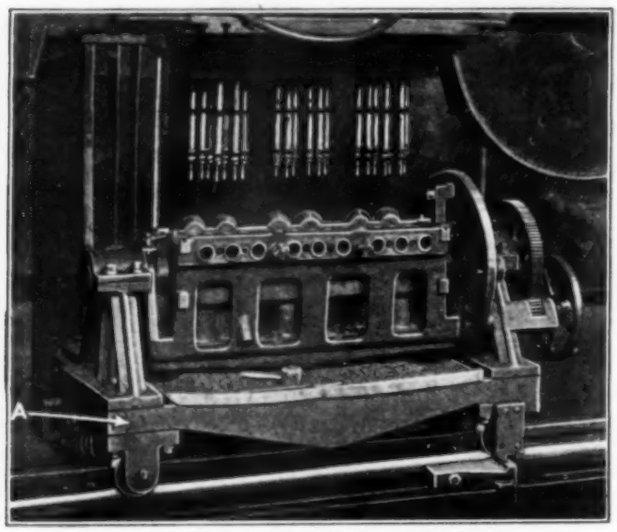


FIG. 8—SOLID BASE TRACK FIXTURE

in turn over pins in the various fixtures. This particular fixture track system contains several more machines than those shown in the photograph. Instead of the operators pushing the fixtures from one machine to another, as is usually the case, they merely throw over the lever *A* and a hook catches in a continuous moving chain that lays in the channel *B* and which pulls the fixture to the next machine and then trips the hook loose again. When the fixtures reach the end of the line they are unloaded and shunted around on a track behind the machines to the other end of the system where they are reloaded and ready to start another trip down the line.

Solid-Base Track Fixtures

A type of fixture which is still in use in many factories but which is rapidly becoming obsolete is shown in Fig. 8. This is what is known as the solid base track fixture. The portion *A* is a ribbed casting. As the length of the casting is constant the cradles cannot be changed like they can in a fixture of the tie rod construction. Also, the fixture is very hard to move because of the heavy base casting, and the spur gear indexing device is difficult to operate if the cradle is much out of balance. The worm and worm wheel are to be preferred because then it is impossible for a cradle to swing back on its own volition as it can easily do with the spur gear indexing.

There is still much room for improvement in the design of track fixtures but the present trend seems to be in the right direction. The things to be sought are lightness with strength and interchangeability and the present type of tie rod construction combines both of the requisites with the added recommendation that the fixture is comparatively inexpensive.

Don't Run to Hobbies in the Shop

By John R. Godfrey

Old man Johnson had another good object lesson for his son Tom the other day. One of his competitors, the Black Motor Co., has been getting into difficulties because it could not compete with the lowered prices on account of shop costs being too high, and most of the old management has been transferred, or fired, "for the good of the service." Just what is to be gained by the change remains to be seen, for it sometimes happens that the cure is worse than the disease.

"Tom, my boy," he was saying just as I dropped in, "it's simply another case of being one-sided, of letting your mind run along in one groove instead of considering all sides. Ed. Hughes was a mighty fine fellow and a great manager, when it came to handling men. He got more out of his men during the war than any manager I know of, and at a fair wage. I'll guarantee that no other man could have handled that shop as well as he did under the war conditions. He knows human nature from the ground up and every man in the plant loved him like a brother.

Only One Phase of Work Considered

"But he was so interested in the human relations side that he plumb overlooked the machine end of the shop, and he wasn't strong on modern methods of production. Some of his jigs and fixtures came over in the ark and his machinery was far from modern. If his men hadn't been strong for him, and worked their level best, he'd have fallen by the wayside long ago. Of course the time came when some one tipped off the higher-ups that the machinery was out of date and then the bankers sent an efficiency engineer to look the place over, and you know the answer. Ed. Hughes is transferred to another job and his men aren't any too happy over it. The new man will have a heck of a time because he doesn't know human nature as well as Ed did, and altogether, things don't look any too bright for the Black Company.

Management Mus Not Be One-Sided

"If Ed. Hughes had only paid half as much attention to new machinery and new methods as he did to the handling of men, none of us could have touched him on production costs. For the best machinery in the world depends on the real co-operation of the men who run it if you want to get the very utmost out of it. And Ed's men did that very thing. I'll gamble that none of us could have equalled his production with his out-of-date equipment. You see, Tom, his mistake was in thinking that personnel was the whole thing. I believe its the biggest thing, but there are a lot of other things to look after too.

"Don't get one-sided, Tom. Don't let any notion, no matter how good it is, get such a hold on you that it blots out all the rest of the works. That's where the trouble comes with a lot of us. The ideal way is to have a first class man for each of the different phases of the job while you sit back and try to get a real perspective on the whole thing. Then you can balance one up against the other and see that they all have proper attention. If you can do that, you'll make the Johnson Motor Co. so much bigger and better than I've done, that I'll be getting peeved about it."

The Elements of Production Grinding

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

The second article — Manufacture of wheels — Modified abrasives — Vitrified, silicate and elastic wheels — Grains and grades—Various combinations of grains

THERE IS comparatively little difference in actual hardness between the two kinds of artificial abrasives. Silicon carbide is slightly harder than aluminous oxide but it is also somewhat more brittle, the difference in this respect making it more adaptable to the grinding of certain classes of work and less so to others. Aluminous oxide is susceptible to certain modifications sometimes called temper, which do not change its actual hardness but appear rather as a difference in the structure of the crystal.

The hardness of a wheel is, therefore, not a matter of the abrasive but of the bond. Even in this respect it is not "hardness" as we apply the term to other materials, but is rather a combination of density and tenacity; a property of resistance to the tearing out or breaking away of the particles of which the wheel is composed. It is determined not only by the nature of the bonding material but by the density of the mixture and to some extent by the size of the abrasive grains used in it.

TO BECOME proficient in the art of grinding, the operator should know of what his wheels are made, how they are made, and how the characteristics of each affect the work in hand. He must know their limitations as well as their possibilities. He should be able to determine the nature of the abrasive as well as the approximate grain and grade of a wheel upon which there are no identification marks. In order to do this a comprehensive knowledge of the fundamental principles of wheel making is essential.

There are three main methods or processes of making grinding wheels, designated in accordance with the nature of the material that cements the particles of abrasive together as vitrified, silicate and elastic wheels. Of the latter class there are two kinds, known as "shellac" and "rubber" wheels. Either abrasive is used with any bond.

The elastic is the oldest form of solid wheel. Various sticky substances have been used as bonding materials but shellac and rubber are practically the only ones surviving. With either material it is practical to make very thin wheels that could not be run with safety if made by any other process. Rubber bonded wheels are very strong, and will retain their size and contour under conditions that would soon break down any other kind of wheel.

Shellac wheels are made by putting a measured quantity of abrasive and shellac in a steam heated mixing machine where they are thoroughly mixed at a temperature that causes the shellac to flow. Each grain of abrasive thus becomes coated with shellac, and when the material is ready it is rolled out into sheets of a thickness corresponding to that of the desired wheel, from which the wheels are cut with a die. Shellac wheels are also made in metal molds into which the material is forced under a hydraulic or other form of press. The wheels are then packed in sand and baked in a gas-fired oven at a temperature not exceeding 300 degrees.

Rubber wheels are made by taking a sheet of pure rubber, to which sulphur has been added as a vulcanizing agent, spreading the abrasive upon it, folding the sheet upon itself and passing it through a pair of rolls. More abrasive is then added, the sheet again folded and rolled. This process is continued until the desired quantity of abrasive has been thoroughly kneaded into the rubber, when the wheels are cut out of the sheet with a suitable die and vulcanized under heat and pressure.

Elastic wheels cannot be classed as "production" wheels. The amount of material that can be removed by them in a given time is small and they cannot be forced, as the heat generated by friction would soon destroy them. Their principal field is in forming intricate shapes on tool steel parts, such as forming tools. Though they are not rapid producers they hold their place by reason of being able to do what no other kind of wheel will accomplish.

The bonding material of a silicate wheel is silicate of soda, commonly called water-glass, to which oxide of zinc is added as a waterproofing agent. The abrasive grains are thoroughly mixed with the silicate and the mass is then tamped into metal molds and baked in a gas or coal fired oven for a period of time ranging from two to four days, depending upon the size of the wheel.

The silicate wheel has some advantages over its vitrified contemporary, one being that special wheels can be made to order in a much shorter time than is required to "burn" the vitrified wheel. Another advantage is that they can be molded in or on iron backs or centers designed to go into certain kinds of machines. As the maximum baking temperature does not exceed 500 deg. F., the iron is not affected by it, whereas the high temperatures of the vitrifying kiln would melt it away.

The silicate wheel seems to be more free cutting

than a vitrified wheel of the same grade. Though it is not actually softer it will *appear* to be softer in action, and this fact must be taken into consideration when changing from vitrified to silicate wheels and vice versa. A disadvantage of the silicate wheel is that it is susceptible to damage from causes that will not affect the vitrified wheel. It will absorb moisture to some extent and, though it may be run indefinitely under a flood of water or grinding compound, it should not be allowed to stand in water or even in damp places, otherwise it may become hopelessly out of balance.

Approximately 80 per cent of the wheels used in production grinding are made by the vitrified process, which, as its name implies, consists of fusing pottery clays with the abrasive grains. Feldspar and various kinds of fusible and refractor clays are used, each

FIG. 10—MIXING BOWLS IN WHICH THE ABRASIVE AND BOND ARE MIXED

maker of wheels having his own formula of materials and proportions. Endless combinations are possible but the processes are in the main alike.

In Fig. 10 may be seen a row of mixing kettles in which the bond and abrasive are thoroughly mixed with water. When the proper consistency is reached, the mixture is drawn off at the bottom into a mold which consists of only a circular tile slab with a hoop of sheet metal laid upon it to confine the mass to a roughly circular form.

In this shape the wheels resemble nothing so much

FIG. 11—MACHINE FOR SHAVING THE WHEELS

as a row of "mud pies." They are taken immediately to a steam-heated drying room, where they are placed upon racks to remain until the water has dried out sufficiently to allow them to be handled. When this stage is reached, the hoops are removed and the wheels taken to the shaving machine, Fig. 11, where they are dressed off on both sides and the periphery turned, leaving sufficient stock to permit them to be again faced and turned after burning.

As the wheel at this stage is of the consistency of dried mud, the turning and dressing are accomplished without difficulty. The machine is a "potter's wheel," over which is mounted a tool slide capable of movement in both horizontal and vertical planes. The roughly circular slab of mud is held upon the revolving table by its own weight and requires no fastening.

Large vitrified wheels are made without center holes for the reason that they are thus less liable to crack in firing. After they come from the kiln the center is cut out to the desired size by means of a core-drill, or trepanning tool, made from a piece of tubing.

Burning the Wheels

Though a great deal of care is needed—and exercised—in the preparation of the wheels up to the time of firing, it is in the kilns that the critical point in the process is reached. A kiln like the one shown in Fig. 12 may contain several thousand dollars worth of wheels that a few moments of carelessness or inattention on the part of the operator could easily reduce to scrap value—which is practically nothing.

Each wheel is laid on a circular tile and surrounded

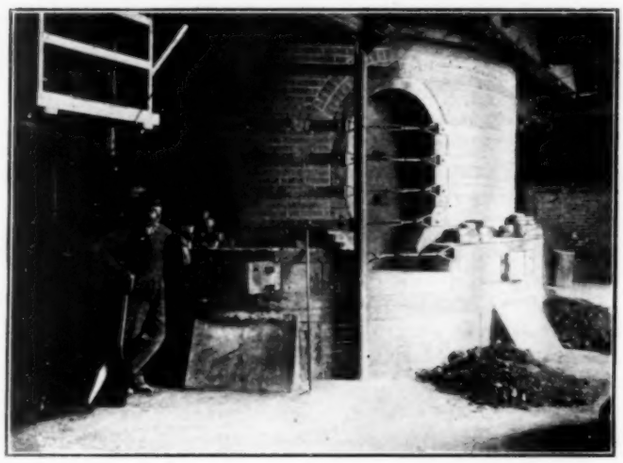


FIG. 12—A KILN IN PROCESS OF FIRING

by the segments shown in Fig. 13, so that though a stack of wheels may be as high as the kiln will admit, no weight comes upon any individual wheel. When a kiln is filled the doors are sealed and the fires started in the furnaces.

The time required to fire a kiln depends to some extent upon the size of the wheels, and it is desirable to have the entire charge as nearly as possible of one size. The average time of firing is approximately 120 hr. After the fires are started they are allowed to burn very slowly for several hours until the water has been thoroughly dried out of the wheels, for if the firing was hurried at this point the steam generated within them would cause them to disintegrate. Another critical time is when the chemically combined water is expelled, at about 1,000 deg. Fahrenheit.

In the preliminary stages of the firing the temperature is observed by means of electric pyrometers and it is kept slowly rising until the final temperature is reached, when the kiln is sealed up tightly with fire clay and remains in this condition until it has cooled sufficiently to allow the workmen to enter; a matter of several days.

Though the temperature of a kiln is always under observation through the medium of the electric pyrometers, the final temperature is determined by means of Seger pyrometric cones, several sets of which are placed in the kiln at points where peep holes are provided through which to observe them.

The cones are made of fusible clays, the mixture of each being so calculated as to melt at a definite temperature. As the process of firing nears completion

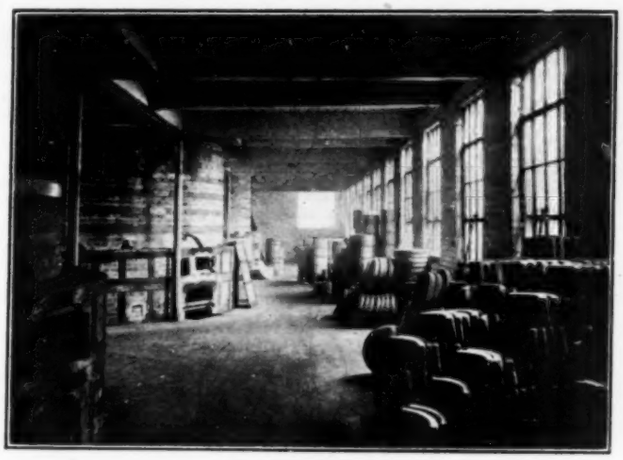


FIG. 13—TILES BY WHICH WHEELS ARE PROTECTED IN FIRING

and the heat, which has been kept rising slowly and steadily, reaches the melting temperature of the first cone, the latter collapses.

From this point onward extreme care is demanded, as there is a range of but 30 deg. between the melting temperature of the successive cones and the heat of the kiln must be so controlled that four of them in each set, located at widely separated points in the kiln, will melt and leave the fifth one upright. The sets of cones shown in Fig. 14 indicate a satisfactory run.

Wheels used upon cylindrical and surface grinding machines for the purpose of producing work to accurate dimensions are made up of grains ranging in size from No. 24 to No. 120. Coarser grains are used to make wheels for free-hand grinding, snagging castings, etc., and finer grains may be called for in specific cases, but rarely will the operator of a production grinding machine find it necessary to select wheels with grains outside the above range of sizes.

The grain size of a wheel is designated by a number and this number will always mean the same thing regardless of the name given to the abrasive or the maker of the wheel. Not all wheels, however, consist entirely of one size of grain. All wheel manufacturers make "combination" wheels, containing definite quantities of different sized grains. Thus a wheel designated as No. 24, will be made up entirely of grains of this size while a designation such as No. 24-40, or 24-46-100 indicates that these sizes are mixed together in proportions known to the maker.

Another designation which will puzzle the beginner

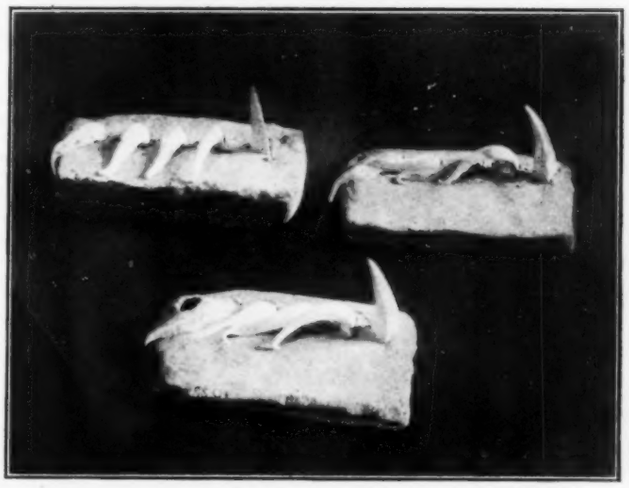


FIG. 14—PYROMETRIC CONES AFTER FIRING

is that indicating the presence of a modified abrasive. This condition is also indicated (in most cases) by a number prefixed to that indicating the grain size. The grain sizes within the range we are considering are: 24, 30, 36, 40, 46, 60, 80, 90, 100 and 120. Modified abrasives are indicated by various makers as 13, 17, 22, 38, 77, 99, etc., used as prefixes. It will be noted that in each case the prefixes are numbers that cannot possibly represent grain sizes.

Thus a number 36 wheel would be one that contained only No. 36 size of the regular abrasive while 1,736, 3,836, 7,736, etc., would indicate that the wheel, though of the same grain size, was made of the modified abrasive. Other makers would designate such wheels as AA36, W36, Special 36 and so forth.

Though some wheel makers designate a combination grain wheel by the numbers indicating the actual grain size, others indicate the combination only by a number that refers to a formula in their possession. Thus a No. 401 or 403 wheel is a combination wheel in which the predominating size of grain is 40 and the mixture in accordance with the maker's formula No. 1 or No. 3 as the case may be.

Designation of Hardness

The relative hardness, or "grade," of a wheel is usually (though not always) indicated by a letter, but in this matter, as in the numerical designation of combination wheels and wheels of modified abrasives, there is deplorable lack of uniformity. While the grade scale of one maker may run along the alphabet from A to Z as the wheels increase in hardness, that of another may run in the reverse direction and the letter A indicate the hardest possible wheel. Some wheel makers grade by numbers only, and others by a combined letter and figure. Elastic wheels are usually graded by number.

This is a condition that helps to becloud the art of grinding in a fog of mystery, and efforts should be made by wheel makers and users to establish a standard system of grading by which a given letter and figure would indicate with certainty just what might be expected of a given wheel, regardless of who made it. Thus relieve the harassed operator of grinding machines of the necessity for memorizing a mass of unrelated symbols or of compelling him to search frantically for a reference table every time he desires to change a wheel on his machine.

World Trade in Metal Working Machinery—Exports

Prepared by Industrial Machinery Division, Bureau of Foreign and Domestic Commerce

United States, 1922

Supplement to table published on pages 730-731, Vol. 57.

Countries	$
Germany	77,120
England	1,767,177
France	1,034,532
Canada	1,640,905
Russia in Europe	930
Belgium	163,105
Austria-Hungary	
Italy	82,157
Australia & Tasmania	415,830
Brazil	240,666
Sweden	31,039
Netherlands	52,562
Argentina	158,556
Japan	1,480,777
Mexico	449,469
Scotland	136,321
Cuba	238,199
Spain	229,745
Norway	23,973
Denmark	23,593
New Zealand	70,360
Chile	206,324
British India	2,404,884
Panama	10,820
Br. South Africa	62,186
Philippine Islands	57,771
Peru	74,664
Finland	3,515
Switzerland	8,996
Dutch E. Indies	14,471
Straits Settlements	12,532
China	319,237
Uruguay	6,622
Portuguese Africa	2,973
Japanese Leased Ter. (China)	14,712
Venezuela	72,089
Colombia	77,676
Turkey in Europe	1,764
Ecuador	9,688
Newfoundland & Labrador	4,091
German Africa	
Ireland	243,056
Portugal	2,201
Chosen	1,737
Costa Rica	6,211
Turkey in Africa & Egypt	
Santo Domingo	8,789
Other Br. E. Indies	21,13
Hongkong	22,951
Br. W. Indies—Barbados, Jamaica, Trinidad, Tobago and Other Br.	27,464
Bolivia	16,102
Turkey in Asia	
Salvador	4,070
Russia in Asia	
British Guina	329
Roumania	5,688
Guatemala	10,310
British West Africa	191
British Honduras	703
Greece	755
Nicaragua	3,280
Siam	5,649
Haiti	2,941
French Oceania	607
Honduras	24,284
French Guiana	
German Leased Ter. (China)	
Bermuda	1,044
Dutch Guiana	9,526
Bulgaria	2,762
Persia	968
French Africa	
Other British Oceania	
Canary Islands	200
French Leased Ter. (China)	
German Oceania	
Danish West Indies	
French West Indies	222
Dutch West Indies	7,788
Azores & Madeira Islands	
Gibraltar	
Iceland & Faroe Islands	
Malta, Gozo, etc	
Paraguay	1,559
Aden	147
Belgian Kongo	656
British East Africa	2,927
Egypt	3,984
Liberia	15
Madagascar	
Morocco	2,830
Spanish Africa	12,854
Fr. East. Indies	
Miquelon, Langley	
Poland & Dantzig	54,962
French Indo-China	2,378
Czecho-Slovakia	8,770
Hungary	20
Yugo-slavia, Albania, etc	
Hedjaz & Arabia	250
Palestine & Syria	3,813
Armenia & Kurdistan	63
Greece in Asia	2,717
British Oceania	57
Algeria & Tunis	9,839
Latvia	2,881
Far Eastern Republic	487
Virgin Islands of U. S.	145
Other Oceania	259
Ceylon	4,624
ANNUAL TOTALS	$12,209,138

United Kingdom, 1921

Supplement to table published on page 804, Vol. 57.

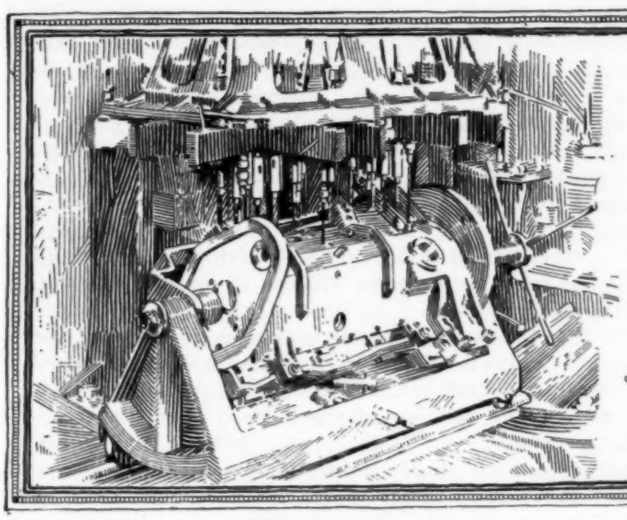
Countries	£
Austria-Hungary	
Argentine Republic	66,157
Belgium	185,412
Brazil	24,518
Chile	35,524
China (Exclusive of leased territory)	97,252
Denmark	380
France	215,446
Germany	70
Greece	3,470
Italy	15,863
Japan, Inc. Formosa	301,676
Netherlands	10,110
Norway	
Portugal	56,066
Russia	136
Siam	14,945
Spain	60,417
Turkey	235
United States of America	5,759
Other Foreign Countries	234,546
Total Foreign Countries	1,327,982
Australia	355,883
British East Indies (British India only since 1920)	780,566
British West Indies	3,716
Canada	1,341
Ceylon	2,994
Egypt	8,945
Federated Malay States	4,070
Hongkong	62,109
New Zealand	29,900
Straits Settlements	34,657
Union of South Africa	141,052
Other British Possessions	134,000
Total British Possessions	£1,559,433
TOTAL	£2,887,415

Value of £ at parity is $4.8665

Denmark, 1921

Supplement to table published on page 924, Vol. 57.

Country	Quantity 100 kg.
Germany	
Great Britain	453
Norway	154
Sweden	144
Finland	61
Russia	164
Netherlands	77
Belgium	492
France	284
Italy	
Austria-Hungary	
Switzerland	
Bulgaria	
Portugal	49
Spain	70
Hamburg	
Iceland & Faroe Islands	
Morocco	
Algiers & Tunis	49
British So. Africa	149
China	218
Siam	160
Dutch East Indies	583
British India	1,201
Straits Settlements	87
Australia	33
New Zeland	
United States	
British North America	
Argentina	901
Brazil	230
Other So. American	39
Other or Unknown Countries	118
Egypt	43
Japan	102
Roumania	39
TOTAL	5,900



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of inspection gages—Importance of indicating devices—Gages for testing relations between surfaces—Gaging of cross-hole location

WHEN a piece of work is being machined, the various operations may be tested and gaged separately; but after the work has been completed, it is often found advisable to make an inspection fixture in order to determine whether the part will function properly and whether the relation of one part to another is correct. There are several methods of testing finished work. One of these methods is by means of fixtures having indicators so arranged that they will show whether the work is machined correctly or not, and at the same time will indicate any variations from the exact sizes which may be found. Another type is in the nature of a receiver gage which the work must fit accurately in certain portions if it is to be considered fit to pass inspection.

The receiver type of inspection gage has many advantages, although it does not show how much variation there is in the work. It simply determines whether the piece has been machined within the required limits of accuracy, or not. If the work is correct it will enter the fixture readily, while if it is not correct it cannot be placed in position. In some classes of work it is possible to gage several portions of the work progressively as the work is placed on the fixture, by allowing certain portions to pass by given points. In other cases the piece must be tested as a unit, and all surfaces gaged at practically the same time. The decision as to which type of inspection fixture should be used for a given piece of work should be determined by the nature of the work, and by the requirements of the piece in the complete mechanism.

An example which illustrates a simple type of inspection fixture for a somewhat difficult piece of work is shown in Fig. 547. The various operations on the work *A* and some of the fixtures used for this part have been described in one of our articles on jigs and fixtures. Very great accuracy is required in the machining of this part, and the holes *C* and *G* and the teeth in the sector *B* must be cut in a certain relation to each other. The inspection fixture consists of a plate *E* in which the stud *H* is fixed in a bushing *K*, and has two diameters to correspond with the two holes in the hub of the work as shown.

The stud *F* has an inserted plug at *L* which is elongated as shown in the plan view in order to compensate for slight inaccuracies in the center distance between the two holes. This method of locating a stud has also been previously described. Attention is called to the construction of the plug *F* and the locating piece *L*, the latter being so made that it can be driven out and replaced when worn. The position of the sector tooth is determined by the block *D*, which is pointed to the shape of the space between the teeth so that it will

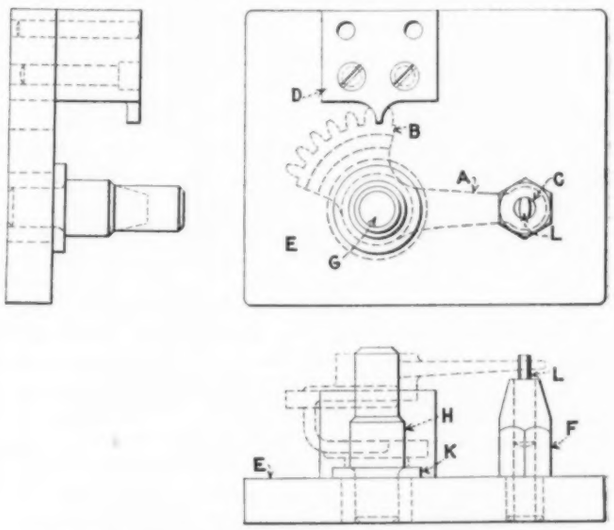


FIG. 547—TESTING FIXTURE FOR SECTOR LEVER

enter if the cutting has been properly done. Otherwise the work cannot be forced into position and it must be discarded. Gages of this general type are frequently used on small parts such as those which are utilized in adding machines, cash registers and other mechanisms of a similar kind.

When there are several machined surfaces which must bear a certain relation to each other, the method of testing used should be preferably so arranged that variations from the correct sizes can be readily determined. In other words, it should be possible to find out in which direction the variation takes place and

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approximately how much it is. The testing can be accomplished in several ways, *viz.*, by means of pointers working on a graduated scale, by using fixed indicators and set-blocks, and by using "feelers" of different thicknesses.

The example shown in Fig. 548 requires the use of "feelers" to determine the variations. The work *A* must be so machined that the surfaces *B*, *C* and *D* will bear a certain relation to each other. The work *A* lies flat on a table, or in some other position where there will be plenty of clearance so that the plug *E* can pass

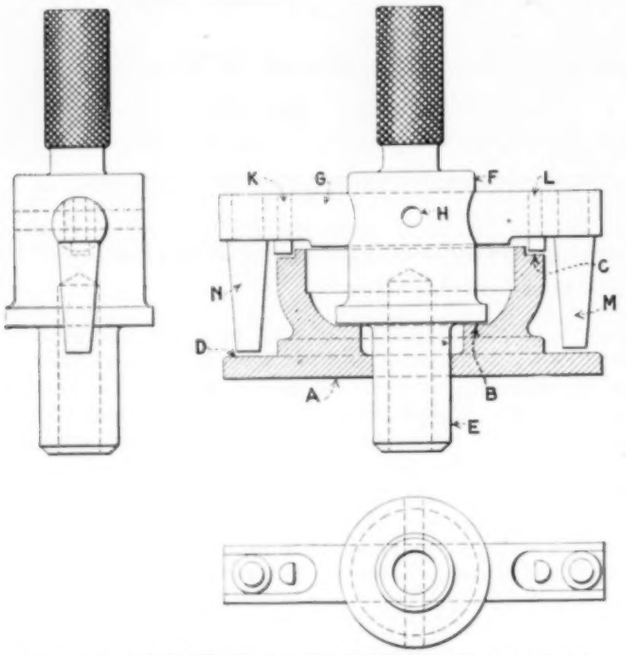


FIG. 548—INSPECTION GAGE FOR TESTING RELATION OF SEVERAL SURFACES

down without interference. This plug is made to fit the center hole, and it has a shouldered portion which strikes against the surface *B*, which may be called the registering surface.

The plug has a knurled handle, and the enlarged portion of the body *F* has a bar *G* passing through it and held in position by a pin at *H*. In this bar there are two pins, *K* and *L*, which are ground off on the ends so that they will allow a clearance of 0.010 in. between their ends and the surface *C*. There are two other plugs *M* and *N* which are inserted in the bar *G*. These plugs are ground off to provide a clearance of 0.020 in. between their ends and the surface *D*. In gaging the work "feelers" of the proper thicknesses are inserted between the ends of the various plugs and the surfaces mentioned, and by using different thicknesses of feelers the accuracy of the work can readily be determined.

There is very little to be said about the general construction of this gage, as it is simple and comparatively inexpensive. A surface plate with a hole in it for the center plug *E* can be used if it seems desirable, but it is unnecessary as the work can be set up on a couple of parallels or on a wooden block with a hole in it. There are occasional opportunities for using this type of gage, and the only objection to it is the fact that the workman may possibly make an error in using the proper size of feeler. The principles of the gage are excellent, and the same type can be adapted to many other kinds of work.

We have previously taken up the matter of gaging the relation of a cross hole to a given surface, but this problem is continually encountered in gaging work, so that a description of several methods which have been found successful will materially aid the designer of gages. In automobile work there are many cases when the position of a cross hole in relation to a surface is very important and if the hole is out of alignment it is likely to cause a great deal of trouble in the finished car. Any sort of a bearing in which a shaft or pin operates must be correctly aligned if proper operation is expected.

In Fig. 549 is shown an inspection gage designed for the cross holes in the casing *A*, which unit is composed of two parts that are bolted together before the test is made. The relation of the holes *C* with respect to the surfaces *B* and *D* is very important, and it can be seen that the inner surface *D* is not readily accessible. As a consequence, some method must be used which will permit gaging to determine the distance between the hole *C* and surface *D*. The method as applied in this case consists of the use of a plug *E*, which is passed through the cross holes and at the same time entered in the unit *F*, which is held in proper position while the plug is being used. After the unit *F* is placed in position, the socket wrench *G* is used to tighten the capscrew *H*, thus making a single unit of the plug *E* and collar *F*. The latter is provided with two gage points *K* and *L*, and a movement of the plug *E* backward and forward allows the operator to judge whether or not the surface *D* is in the proper relation to the hole *C*.

Accuracy in Gaging Cross Holes

The sense of touch is employed in this case, and the judgment of the inspector must be used in order to determine whether the work is within the required limits. It might be possible to make the two points *K* and *L* on the "go" and "no go" principle, so that a real limit gage would be produced. After gaging the surface *D*, a "go" and "no go" feeler gage *M* is used between the surface *B* and the plug *E*. The operation determines the relation of these two portions of the work. This example shows a somewhat extraordinary

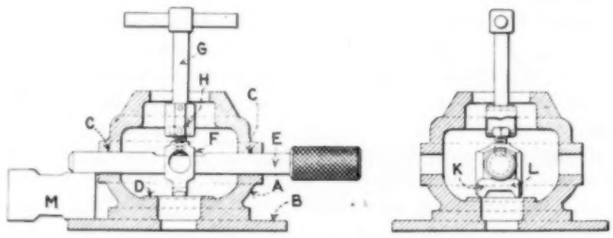


FIG. 549—INSPECTION GAGE FOR CROSS HOLES IN CASING

condition which, however, may be met with in certain lines of manufacturing.

The automobile piston is another shining example of a cross-hole gaging proposition. It is of the greatest importance that the wrist-pin hole should be perfectly square with the outside of the piston, in order that there will be no trouble due to a lack of alignment when the motor is assembled. Fig. 550 shows a piston *A* in which it is assumed that the end *B* is perfectly square with the outside of the piston. This assumption is reasonable, as the work is usually located for finishing the outside of the piston from the end surface *B*. With

this hypothesis it would appear safe to use this surface to rest the piston on while gaging the relation of the wrist-pin hole and determining whether it is in alignment or not.

In order that the principles of this gaging proposition may be clearly understood, let us refer to the diagram and note that a pin *C* has been forced through both wrist-pin holes and projects a considerable distance on each side of the piston. Then, if we should set the piston end *B* on the surface plate and pass a surface gage or indicator over the pin at the points *D* and *E*, any errors in alignment would at once become apparent. However, the inspector must place his hand on the piston and hold it down firmly on the plate when making the test. If he is a careful man there should be no great difficulty in determining the relation of the hole to the surface. In the hands of a careless inspector, however, there are chances for error with this method.

Gaging Wrist Pin Holes

In the other diagram the piston *F* rests on a plate *G*, and the pin *H* is forced through the wrist-pin hole in the same manner as previously shown. By using a

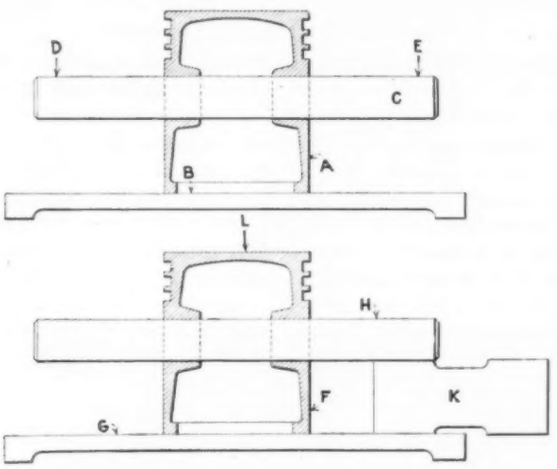


FIG. 550—PRINCIPLES OF GAGING WRIST-PIN HOLE ALIGNMENT

"go" and "no go" gage *K* the operator can tell by feeling whether the two ends of the pin *H* are the same distance from the plate *G*. There is considerable danger, however, in using this method, as the workman must keep pressure on the piston at *L* in order to hold it down on the surface plate. Unless his sense of touch is fairly well developed, he may lift the piston slightly and not obtain good results.

If a method like this is to be employed, it is much better to use instead of a limit gage a size block and feelers of different thicknesses. The longer the pin *H* is, the greater the accuracy which will be obtained. Some manufacturers gage the alignment of the wrist pin from the outside diameter of the piston by laying it in a V-block and using a dial indicator to test the relation of the pin to the outside surfaces. The writers believe, however, that the use of an indicator and the surface plate like that suggested in the diagram at *A*, is perfectly satisfactory in the majority of cases. If it is desired to make absolutely sure that there is no possibility of shift to the piston while inspecting it, a simple clamp can be used to hold the piston down on the plate.

What Should a Boy Study Outside of the Shop?

By A. W. Forbes

AT THE present time it seems as though practically everyone under 21 years of age was doing some kind of systematic study. At least it has been a long time since I have employed anyone who was not. But there seems to be no agreement as to what should be studied. The state of Massachusetts makes certain requirements for boys between 14 and 16 years of age, but there is considerable fault found with the selection by both educators and men in the industries. It would probably be impossible to lay out a schedule for a single boy that would meet with general approval, much less to lay out a rigid system to fit a whole state and convince everyone of its merits.

We shall probably agree that boys should spend some time studying the work they are doing. If they are working in a machine shop, they should read, at least occasionally, some paper like the *American Machinist*, as well as look up specific things in books. I do not see how the principal part of this study can be done in any way except by personal initiative. If at a later day they wish to review their knowledge by attending a course of lectures on the subject, such a course may be advisable, but it should not be confused with real study of the subject.

I should, therefore, recommend that school study be spent in the more general subjects, subjects that will prove of value in giving a better perspective in dealing with men or in considering public questions, rather than in their immediate application. The following list gives my recommendations for boys between the ages of 14 and 21 working in a machine shop. It is not suggested that anyone take the whole list, but only that part of it which fits with his inclinations. Those subjects in capitals are the ones that I consider of greatest value. Those marked with an asterisk are considered suitable for continuation schools for boys between the ages of 14 and 16. I hope that we may be favored with other lists from those who have looked at this subject from other points of view.

LITERATURE
- *ENGLISH
- *ANCIENT AND MEDIEVAL (In translation)
- Foreign in their respective languages

*ENGLISH COMPOSITION (Grammar and Rhetoric)

LANGUAGES
- LATIN
- Greek
- Spanish
- French
- German
- Native Language

HISTORY
- *ANCIENT
- MEDIEVAL
- ARCHAEOLOGY
- *American
- Modern European

ART
- MUSIC
- Architecture
- Painting

MATHEMATICS
- *ALGEBRA
- GEOMETRY
- Trigonometry
- Calculus

PHYSICAL SCIENCE
- CHEMISTRY
- GEOLOGY
- Astronomy
- *Physics

BIOLOGY
- *PRINCIPLES, GROWTH, INHERITANCE
- ETHNOLOGY
- *Physiology and Hygiene
- Botany
- Zo-ology

After preparing this list, I inquired of my employees as to what they were actually studying in the various kinds of schools, day, night, correspondence, etc., as well as under private instructors. The time was spent in the following proportions:

Mechanical Drawing	19	per cent
American History	12	"
Geometry	12	"
English Literature	10	"
Chemistry	10	"
Office Practice	10	"
Music	6	"
Algebra	4	"
Shop Mathematics	3	"
Typewriting	3	"
Penmanship	2½	"
Stenography	2½	"
Trigonometry	2	"
Arithmetic	1	"
English Grammar	1	"
Hygiene	1	"
Civics	1	"
Total	100	per cent

In comparing this list with mine, it is easy to see that I was not often consulted in the selection of studies. But 42 per cent of the time is spent in my preferred list, and another 42 per cent is on subjects which I did not consider of sufficient value to include. Mechanical drawing, which tops the list of what is actually studied is good without any question, but for boys in the machine shop it hardly seems of enough value to include. They are using drawings all the time, and will in this way pick up enough of the subject. Possibly if they worked in a machine shop where all the work was laid out so that drawings were unnecessary, it might be well to have mechanical drawing as a school study. Certainly we cannot find any fault with the subject. It is only a case of taking up the limited time that might be spent on more valuable studies.

A word about my reason for selecting each subject follows:

It is hardly necessary to give a reason for including English Literature, a speaking acquaintance with the best of the English language being so evidently important. But the subject is often spoiled in the schools by spending so much time over books or poems which are so far above the understanding of the pupils that it gives a dislike for good literature rather than an appreciation. I have not yet reached the point where I can appreciate Milton or Burke's "Speech on Conciliation."

Ancient and Medieval Literature is best taken with the respective histories. I do not see how anyone can appreciate Greek History without Homer. Aristophanes' works and a little (a very little) of Plato will also help. In the same way the "Song of Roland" is really essential to an understanding of medieval culture, and the Autobiography of Benvenuto Cellini to the Renaissance. All of these works are simple enough to be appreciated by the ordinary boy, and good enough for the library of the university professor.

English Composition and Rhetoric need no comment.

The reason for studying Languages is not so apparent, and sentiment is quite generally against the ancient languages. We must recognize that very few of the boys will ever make practical use of any of them. I should not recommend them to everyone, but am inclined to stress Latin as one of the sources of our language as well as of all other prominent languages. At the same time, I know those who have studied Greek, which I have not done, who claim this subject to be superior to Latin. Modern languages are recommended for those only who intend to use them, and the study of them had probably be better postponed until their application can be seen. Aside from recommending languages for American boys, sociologists generally consider it a mistake for a person to give up entirely the language and traditions of the country from which his ancestors have come.

It is assumed that every boy will have the foundations of American History before starting work. If he is a recent immigrant, American History should be placed before other history. But in general I would suggest that most of the time be spent in Ancient and Medieval History. Ancient History has the advantage of showing complete civilizations from their rise to their fall. Medieval shows the first thousand years of ours. American and Modern European History includes merely a few hundred years of the prime of a civilization, but so near to us that it is difficult to see the real situation. Modern History too often gives the impression that everything is progress. It takes Ancient History to prove that civilizations can make mistakes and destroy themselves, as every one so far has done.

Need for the Exact Sciences

Mathematics is a much disputed point, and I am not sure that I would recommend anything beyond Arithmetic for the average person. However, those who cannot appreciate mathematics at least to the extent of Algebra should not be in a machine shop. There are other kinds of work, and just as good jobs, where mathematical ability is of no value whatever. Everything in a machine shop is of a mathematical nature, even if it is not expressed in a mathematical language. Of course, Calculus should be reserved for those only who are specially inclined in that direction.

In Physical Science, Chemistry of the materials used is of general shop value, especially when it comes to talking over various heat-treating processes. The laws of Physics are more apparent, and the principles should be observed without a course by anyone inclined in that direction, although often a course is of value in consolidating observations. Geology and Astronomy are for purposes of general culture rather than for any direct application.

In deciding questions of public policy, Biology probably stands next to history in giving a solid basis on which to make decisions. It is interesting to see men in prominent positions in education and social work, making statements that are proved false by Biology; but not enough of the public are familiar with the proved facts to know that the speaker is merely displaying his ignorance. The two main facts of life, growth and inheritance, with the effects of environment on them, are naturally given first place. Ethnology, the study of the races and types of man, is also of evident value. The study of the various forms of plant and animal life, Botany and Zo-ology, is of recognized value though subordinate to the main principles.

In all these subjects the personal element is not to be neglected. I knew one bright boy who had studied fractions in school, but had failed to get the point that there were 100 hundredths of an inch in one inch. When it came up in connection with using a micrometer he seemed glad to get the information. It merely shows the impossibility of trying to force study beyond what the pupil is prepared to receive.

Development of Machine Tools in New England

By GUY HUBBARD

The second article—Beginning of the iron industry—Bog ore carted eight miles to the furnace—Early high-pressure, double-acting steam engine

THE FIRST saw mill in New England was erected on the Salmon River near Portsmouth, N. H., about 1630, and here and there the old "up and down saws" are still in use in primitive mills. The writer discovered one very recently in operation by an aged sawyer in the mountains back of Windsor. See Figures 4, 5, 6 and 7. It is a fine example of the early millwright's craft, both the machinery and the building being without a doubt almost identical with the original Israel Curtis Mill of 1768.

After the Revolution, Windsor rapidly grew to a town of considerable size—one of the most important in the state. From a social and political standpoint it plodded on in the even tenor of its ways, while the saw mill and the grist mill grew to accommodate the increasing population, serving as a nucleus about which grew up other small shops, such as a blacksmith's shop,

FIG. 4—OLD SAWMILL NEAR WINDSOR

wheelwright's shop, a carding mill and possibly a cooper's shop—for Windsor in those unregenerate days was not only supporting an oil mill but also a distillery. These shops served the needs of the town and the hill farmers thereabout, but none of them fulfilled our modern conception of an industry, as no particular product was manufactured upon a quantity basis.

The first representative millwright of the Windsor district was Benjamin Tyler of Claremont, N. H. While Tyler styled himself a millwright, he was in fact a self-taught but highly competent mechanical engineer. In the year 1767, Tyler, then a young man probably just released from apprenticeship, came on foot from Farmington, Conn., to Claremont, which is a few miles below Windsor on the river. The following year he erected a sawmill, and shortly afterward a forge, bloomery and slitting mill, at a fall in Sugar River not far from where it empties into the Connecticut. Thus Benjamin Tyler not only became the mechanical engineer, but also the iron master of the locality, for his forge, bloomery and slitting mill were the Colonial equivalents of the modern smelter, foundry and rolling mill, in which the bog iron-ore from the neighboring town of Charlestown, N. H., was converted into pig and wrought iron.

Bog ore, which was the usual source of native iron

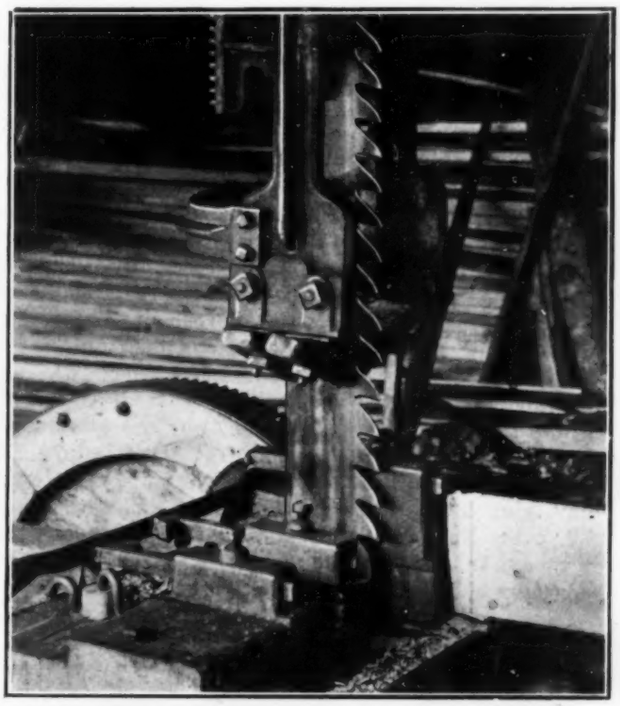


FIG. 5—OLD FASHIONED "UP AND DOWN" SAW

in the Colonies, is limonite, a hydrous-oxide of iron which collected as a sort of mud in swampy places and in the bottoms of ponds. It was anciently believed to be somehow generated by pine and cedar trees, for the reason that they usually grew near where it was found, but actually it was brought in by water. The bog ore of Charlestown was dug out much as is peat and was carried to higher ground where it was washed and dried. It was then carted about eight miles to Tyler's forge where it was smelted in a crude furnace, see Fig. 8, fired by charcoal and blown by a huge

FIG. 6—DRIVING MECHANISM IN PIT BELOW "UP AND DOWN" SAW

bellows, into rather impure iron. It was run either into pigs for casting or into blooms for conversion into wrought iron. The blooms, which were specially shaped pigs, were transferred to the bloomery, see Fig. 9, while at white heat and were pounded under "tilt" or trip hammers—by which means the impurities were expelled and the iron converted into rods or plates of wrought iron. In the slitting mill, which was a primitive shear, the wrought-iron plates were cut into nail rods and distributed among the farmers who spent the long winter evenings in converting them into hand-made nails.

Between 1770 and the end of the century, Tyler did a thriving business building saw and grist mills and producing iron for the district thereabouts and even for far distant customers. He had his own quarries on the southeastern slope of Mount Ascutney, where he quarried and shaped his millstones from the biotite granite, so well adapted to the purpose. Numerous Tyler millstones, which because of their nature have outlived long ruined and forgotten mills, are to this day lying in the beds and along the banks of streams all over New England—lasting memorials of their maker. In addition to being the pioneer mechanical engineer and iron master, Benjamin Tyler was a bril-

FIG. 7—ANCIENT LATHE IN OLD SAWMILL

liant inventor. He greatly improved the crude sawmills and gristmills of his time, invented a new type of waterwheel, and at the time of his death was at work on a threshing machine which he had brought to a point of practical usefulness. That the inventive strain of the Tylers did not die out with him is attested by the fact that his grandson Benjamin Tyler Henry was destined to be one of the most notable Windsor mechanics, and of whom much will be later on said in connection with the development of the Winchester repeating rifle.

Captain Samuel Morey of Oxford, N. H., and Fairlee, Vt., was the second famous engineer and inventor of the Windsor region, and the builder of the canal and locks at Bellows Falls, and at other points above. Samuel Morey, whose portrait is shown in Fig. 10, was born at Hebron, Conn., in 1762, and at the age of four made the journey to Oxford in an ox-cart over wilderness trails—his father, Colonel Israel Morey be-

FIG. 8—REMAINS OF A PRIMITIVE FORGE IN THE WINDSOR REGION

ing the second settler of that up-river village. The Moreys owned great tracts of timberland on both sides of the river, and Samuel gained his early experience in civil engineering in building log slides and canals for lumbering purposes, traces of which are still to be seen near Oxford and Fairlee.

In 1780 Morey became interested in the subjects of heat and light as related to mechanics. One of his first inventions was what was locally called the "Steam Spit" for turning a roast of meat before the fire place. This apparatus was suggested by the ancient "Smoke

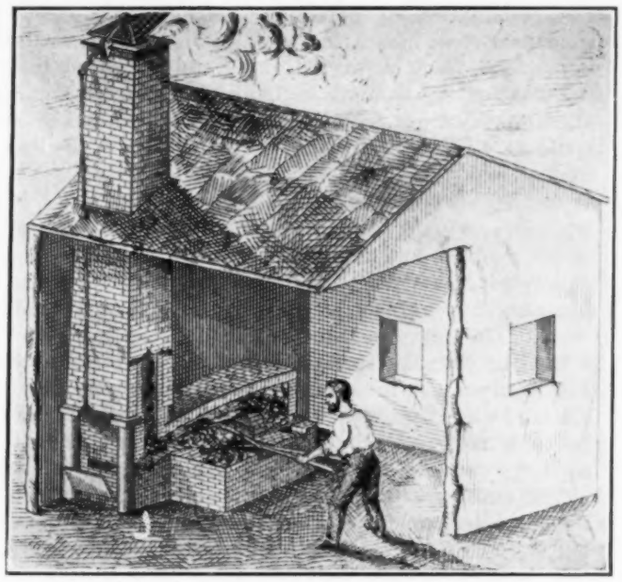


FIG. 9—AN OLD BLOOMERY

FIG. 10—CAPTAIN SAMUEL MOREY
(Drawn from an oil painting.)
Courtesy of Granite State Magazine

Jack," but Morey derived his power from the steam of the tea-kettle instead of from the draft in the chimney. About the same time he succeeded in generating illuminating gas from steam and tar, which apparatus he describes in articles published in the *Journal of Science and Arts*. These articles brought him into communication with Professor Silliman, of Yale University, and resulted in a lifelong friendship between Morey and that scientist.

The success of the "Steam Spit" led Morey to continue his investigations in the development of steam power, and he gradually developed a successful high-pressure double-acting steam engine of the revolving type. Aside from being one of the earliest high-pressure engines (contemporary with that of Oliver Evans) it was novel in its revolving principle, being much like the Gnome motors now used in airplanes. A working model of this engine, see Fig. 11, which was skillfully made by Morey himself about 1790, is preserved in perfect condition at the Museum of the Vermont Historical Society, and it was from this model that the author obtained his knowledge of the machine. See drawing Fig. 12.

The center of revolution of this model is a valve seat in the form of a disk 1¼ in. in diameter, which is mounted on a tube connected with the boiler. In this disk are two recesses, one connecting with the boiler, and the other with the air. The frame of the engine consists of a narrow casting 6½ in. long, having at its center a valve disk corresponding to the valve seat. To one side of the disk projects the bed to which the cylinder is fastened, while to the opposite side projects the slide in which the crosshead works. The cylinder is of brass 1 1/16 in. in length by 1½ in. in diameter. It has a 1⅜-in. bore and is fitted with a cast-iron piston packed with tow. The stroke is 1⅛ in. The valve disk has two holes upon opposite sides, so placed as to come over the openings in the valve seat during revolution, and these holes are connected by brass tubes to the ends of the cylinder.

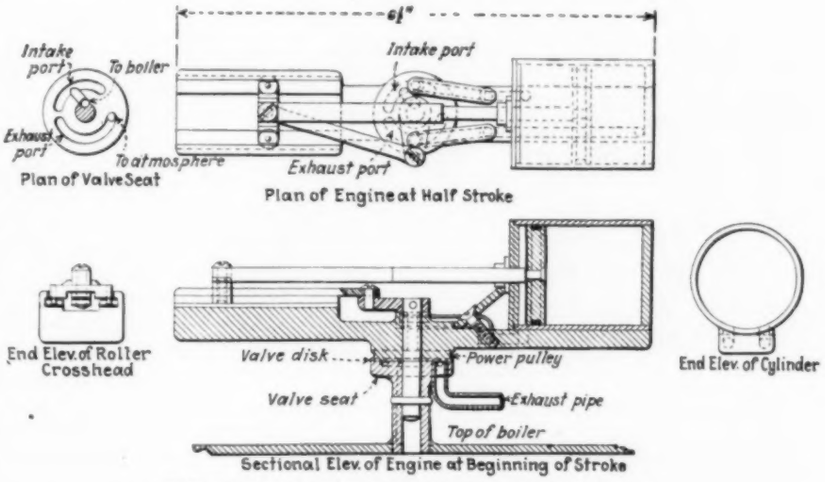


FIG. 12—DRAWING OF MOREY'S ENGINE, 1790
(From the model at the Vermont Historical Society.)

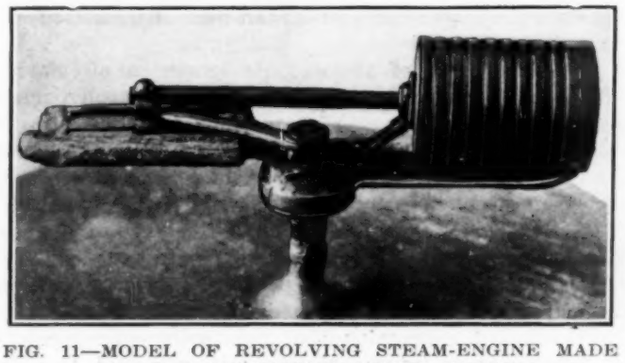


FIG. 11—MODEL OF REVOLVING STEAM-ENGINE MADE BY CAPTAIN SAMUEL MOREY IN 1790
Courtesy of Vermont Historical Society

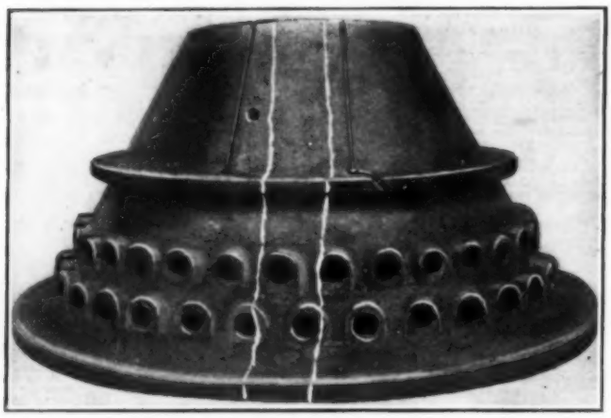
The piston rod passes through a stuffing box and carries at its outer end a roller crosshead working in the slide opposite the cylinder, while the connecting rod projects back from the center of the crosshead beneath the piston rod. A crankshaft, serving also as a main shaft for the engine, is anchored vertically in the valve seat and projects through the valve disk, which serves as the main bearing of the engine. At the upper end of the shaft is fastened a crank, to which is attached the free end of the connecting rod.

The valve disk is so placed with relation to the valve seat that as the piston starts from the end of the

cylinder the hole connected with that end comes to the opening in the valve seat which connects with the boiler. This admits steam to that end of the cylinder during the first half of the stroke, it being allowed to expand during the last half. Meanwhile, during the full stroke, the hole connecting to the other end of the cylinder is passing over the opening in the valve seat which communicates with the air. As the steam is admitted the piston is forced down and the entire machine is turned by the reaction upon the fixed crank. When the piston reaches the end of its stroke the holes in the valve disk change places in regard to the openings in the valve seat and the action is reversed, the steam being taken at the opposite end of the cylinder and expelled from the other end into the air. The valve action being automatic, the engine spins upon its disk, getting two power impulses per revolution.

Saving a Cracked Five-Ton Casting

If a user should fail to solve a particularly difficult problem without exhausting every possible means offered by the oxyacetylene process when an emergency occurs which requires more than ordinary results he loses to a large degree one of the greatest assets of a welding and cutting outfit. The service derived from oxyacetylene equipment on work that is the same each day is commonplace. When the unforeseen breakdowns or mishaps occur and there is a vital need for accomplishing something



THE COMPLETED WELD BEFORE BEING GROUND

out of the ordinary it is in such contingencies that the process can be relied upon to repeatedly demonstrate its worth.

A user may go for a long period obtaining satisfactory results without outside assistance, but when "lightning strikes," when help is needed most, what can be accomplished by welding and cutting on an emergency job is sometimes worth many times the value of weeks of ordinary service. Such was the case recently in an Eastern foundry when a large gray iron jet condenser cone unfortunately cracked through its entire length and thickness because it was removed from the sand too soon.

The cone was part of an equipment order contracted for shipment on a certain date. There was no time to make another casting as this would have required from three to four weeks.

Although the foundry has oxyacetylene equipment and is using the welding process to a large extent in the reclamation of defective castings, this 10,000-lb. condenser cone, measuring 10 ft. in diameter at the large end and 3 ft. 8 in. at the small end appeared beyond reclamation by welding to both the management and the foundry operators. Yet unless the cracked cone could be welded the foundry would stand a large loss in money and the harm which would necessarily result from their failure to make delivery as promised. They, therefore, sought in haste the best oxyacetylene engineering advice and service they knew.

Twelve hours after the foundry's call for help an oxyacetylene engineer was on the job to superintend the work. The entire casting was moderately preheated in a built-up charcoal furnace before the engineer arrived. For convenience in welding, the casting was lifted on end and a scaffold was built around it for the operators to work from. Then the cracked area was heated to a cherry red and actual welding operations were begun.

The welding required 8½ working hours. Eight hundred and seventy-five cu.ft. of oxygen and eight hundred and fifty cu.ft. of acetylene were used. The welded section was 6 ft. long and averaged 2½ in. thick. The accompanying illustration of the completed weld was taken before it was finished off. After the surface had been ground it was almost impossible to distinguish the welded section from any other part of the casting.

The prompt and effective service rendered in this instance accelerated the solution of the foundry's problem. The very satisfactory welding prevented an embarrassing situation as there was considerably more involved than merely the reclamation of the cracked cone.—From *Oxy-Acetylene Tips.*

Visitors in the Shop

BY WILLIAM J. FISHER, JR.

Every shop has visitors at times some on business, some to see interesting operations, and some for no apparent reason. We had two of the latter class in our shop this summer who came without invitation, stayed several weeks and departed without saying good-bye.

Two wild birds flew into the shop one day and, after looking us over and prospecting around for a while, selected a site for a nest directly behind the starting box of our motor. Here a nest was built, eggs laid, and a brood of fledglings hatched and reared until they were able to fly.

The starting box is bolted to a plank that is in turn nailed to the studding of the side wall of the shop. A space in the plank is cut away to give clearance to the hand, and the hand of the man whose duty it is to start the motor came within an inch of the nest several times a day.

In that end of the shop is located a circular saw for sawing hardwood logs, and this, naturally, made a terrific noise when in operation. A 36-in. lathe was also in constant service near by, and the flying sparks from a dry tool-grinder would be showered all around the nest at times, yet the birds were not disturbed.

Our shop is located within a few feet of a natural park that affords countless home-sites for birds, and the only reason I can assign for the strange preference of this pair is that they had observed the peaceful and benevolent expression that habitually overspreads the countenances of machinists and reasoned therefrom that their peaceful haven would not be disturbed.

Industrial Cost Accounting for Executives

By PAUL M. ATKINS

The seventeenth article—The scheduling or budgeting of expenses—Uses and development of expense schedules—Scheduling of maintenance, power, supply, wage and salary costs

IT IS A comparatively easy matter to record a series of transactions like those which give rise to expenses if adequate provision has been made for them. When the mechanism for expense recording which has been described in the previous article has once been set up and is smoothly running its operation becomes substantially a matter of routine, broken, it is true, when errors are made from time to time. The real utility of such records, however, does not lie in their historical interest, though that phase must not be overlooked, but in the aid which they give in planning for the future.

The executive who is a real leader of his company is the one who looks into the future and evaluates its possibilities. We see the growing realization of the importance of forecasting in the management of a business in the increasing use of charts which endeavor to show the future trend of business, and great progress has been made in recent years in the development of such business aids. As far as the outside business world is concerned, the executive is probably wise to rely on such outside services rather than to try to build up his own except as it may be needed to supplement or fill in gaps which are of vital importance to him. Only the largest concerns can afford individually to embark on such a program on a scale which will bring worth while results. As far as the internal phase of a business is concerned, however, it is entirely up to the company itself to develop means for evaluating the future. No one except the company managers are in a position to establish the records which will make possible such forecasting, and no one but they are interested in it.

The Essentials for Scheduling Expense

Under most conditions, the best way to arrange the analysis of future possibilities is in the form of what is often called a master schedule, a schedule which is developed out of the many subordinate schedules and which, in turn, serves to control them as their preliminary layout is manipulated into more permanent form. Reference has already been made to the schedule in the article on the Control of Production as an Aid to Cost Accounting. It will be remembered that mention was made of the balancing of sales possibilities and factory capacity as the basis for developing such a schedule, and that interlocked with them are such schedules as finances, purchases, labor, and expenses.

As expenses involve in most cases the actual expenditure of money it is evident that the principal channel through which they affect the master schedule is through the financial schedule. Having laid out the tentative sales and production schedules, it is then possible to estimate the expense schedule, incorporate that in a tentative financial schedule and in combination with the other tentative schedules, a definite master schedule can be prepared. When this has been done it is then possible to turn the tentative expense schedule into what is substantially a permanent schedule.

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Value of Expense Schedules

Perhaps someone may be on the point of inquiring in regard to the difference between an expense schedule and an expense budget. From many points of view the two expressions are synonymous in that they both deal with a present evaluation of future costs. In the business which is subject to little or no seasonal fluctuation, they are practically the same in all respects, but in the seasonal type of industry they have marked differences. The term schedule is used in the discussion to draw attention to a very important factor in the make up of the expense forecast which is otherwise often overlooked. When speaking of budgets, expenditures over a period of time are commonly thought of, without regard to the time when such expenditures are to be incurred. In dealing with any financial schedule or program, of which an expense schedule is a part, it is quite essential that the time when the disbursement is to be made be known if the finances are to be easily and satisfactorily handled. Where the expenses run along at an even rate as in a non-seasonal business, that essential does not have such significance as in the seasonal industry where the fluctuation in the expenses may be very great from period to period.

There are two uses to which the expense schedules are put in the operation of the business. One has already been described—the aid received in the preparation of the master schedule. The other service consists in acting as a measuring device by means of which actual accomplishment can be measured. It is, of course, desirable to know whether expenses are going up or down, but that knowledge by itself does not mean much. Expenses may be going down and still be far too high. If an expense schedule has been prepared beforehand, then it is possible to see how actual results depart from a scientific forecast of what they ought to be. The comparison furnishes one, the only one, of the ways for measuring the efficiency of departmental managers. Care must be taken in making it to consider any events or developments which may be causes for differences between results and forecast, and which are not under the control of the manager affected. In some cases, causes arise within the business as well as without in the shape of changing business conditions.

There are various ways for going about the develop-

ment of expense schedules. In some cases, expenses over a long period of time will be used as a starting point and broken up into their details and into shorter periods. Fixed changes, for example, are developed in this manner. On the other hand details may be assembled to form the needed totals. The scheduling of the wages and salaries accounts is usually developed in the latter manner. In all cases, however, two factors must be taken into consideration—the past records and the probable future as expressed in the master schedule.

Our next task is to study some of the principal expense accounts and see how schedules or budgets for them may be worked out. In the article dealing with the fixed charges the method for working out the fixed charge schedule was explained in such detail that further discussion of it here is hardly necessary. It must be remembered that the schedule for fixed charges and the actual amount of those charges is the same because of the nature of the expense, and so there can be no deviation of actual from scheduled charge.

The Scheduling of Maintenance Expense

The various maintenance accounts present some interesting problems. There is no question about the certainty of these costs, but their amount and the time of the occurrence are frequently not easily determined. Let us consider the building maintenance first. The regular house-keeping work as the daily and weekly clearing has been so aptly called, may be scheduled with a considerable degree of accuracy. Under exceptional circumstances time studies are made and definite standards set for sweeping, removing chips and washing windows. If this is not done records of past performance give usable though not so accurate data with which to work. When the time required is known and the probable future rate of wages for the work has been determined it is not difficult to ascertain the labor cost. The materials used can also be ascertained from past records and the price forecasted with reasonable accuracy. Usually the cost of such articles as brooms and cleaning powders are not so great as to cause any marked departure of estimates from actual expenditures.

When we consider the more extensive overhauling which must be done from time to time, it is not so easy. An investigation on the part of the plant engineer ought to give a good basis for estimating the expense. The plant engineer should make a periodic inspection of the buildings and prepare a report showing the probable extensive repairs for the forthcoming fiscal period. The report should also indicate at what time the work should be done, a matter which will depend upon the season of the year for exterior repairs and on the busy and slack seasons for those within.

Provision must be made for the distribution of the repairs, the benefits of which are to be obtained over a considerable period of time. Such items as new surfacing of floors or of roofs fall in this class. Ordinarily it is not necessary to make such repairs more often than once every three or four years, and so it is hardly appropriate to charge against one year the costs which properly should be allocated to several years. In such cases, therefore, only the part which it is decided really belongs to the year in question should actually be entered in the schedule.

The third class of building repairs, the emergency class, which result from unexpected breakdowns, can be estimated only on the basis of past experience. However, after records have been kept for a period of years, it is usually possible to estimate very closely the actual expenditures of such nature.

For building maintenance it is frequently necessary to work on the basis of the entire building and then pro-rate the resulting schedule to the several departments on a floor space basis. Such items as the repairs to walls, roof and foundation can only be handled satisfactorily in some such manner. The expense of toilets and locker rooms can be handled as totals, but the distribution should be on the basis of the number of employees in the several departments and not on the floor space. Some departments like the store-room properly bear a large portion of the total building expense because of the space they occupy, but because they have few employees their use of locker and toilet rooms is small.

When the various items have been obtained in some manner it is then necessary to sum them up to give departmental totals taking care to show monthly variations. For some purposes monthly variations are smoothed out, particularly when burden rates are being prepared on the basis of scheduled expenses, but for the purpose of making up the financial schedule it is necessary to show the fluctuations in detail.

In studying the problem of the maintenance of machinery, we find many of the same problems as have already been discussed in connection with buildings. In fact, it is often hard to draw a line in the records and schedules between these two classes of maintenance for the regular cleaning and general upkeep. The men who clean the floors often oil and wipe off the machinery at the same time. On the other hand, in some factories it is common practice to have each man take care of his own machine and to allow a certain amount of time each day or each week for the purpose. Under the latter conditions the scheduling of the machinery cleaning expense is not difficult.

Recording Maintenance of Equipment

The second class of machinery repairs, the extensive overhauling from time to time, can also be estimated without any serious difficulty in most cases. The same kind of report from the plant engineer that was described in the discussion of the repair of buildings is often helpful. In addition, if the plant register is kept as was described in the article on Depreciation and Other Fixed Charges a record of the overhauling repairs to each machine in the plant is at hand. The record will show the amount and dates of former repairs, and in connection with the plant engineer's report should furnish any needed information for the scheduling of the repair expense. As in the case of buildings, the unexpected breakdowns can be provided for only by a general estimate.

One of the important points to remember in connection with the scheduling of the maintenance of the equipment already described, and of the group called furniture and fixtures in addition, is that the amount of the expense very often does not fluctuate in the same sense as the variation in the volume of business. The dull seasons are usually the times when the larger part of this kind of repair is carried on since it does not interfere with production and men are commonly available. That fact needs to receive due consideration in the preparation of the schedules, for it has peculiar significance in connection with the financial schedule.

The cost of tool maintenance is in a rather different class from the other kinds of maintenance in respect

to its scheduling. Here we ordinarily find that the repairs vary in the same sense and substantially in the same ratio as the volume of production. This is particularly true for the edge tools which are rapidly used up by repeated sharpening. Hence the schedule for the expense will follow very closely that for production. It should also be remembered, in this connection, what was said in a preceding article about the method of treating depreciation of tools. Instead of having a reserve for depreciation account for the asset, the tools are carried at one-half of their original cost value and all tools issued to replace those worn out are charged to the tool maintenance accounts. Where the method is followed, it is, of course, necessary to include the probable cost of tool replacement in the scheduled tool maintenance.

Liability insurance is an item which appears in practically all departments and hence must be provided for in detail in the expense schedule. Since the premium usually depends on the amount of the payroll and that in turn on the production schedule, the amount of the liability insurance can be forecasted without difficulty in all cases where production can be estimated with some degree of accuracy.

Power is consumed by many of the departments of the average factory. Its scheduling is easier where it is purchased from outside suppliers than when it is produced by the factory itself. It is not so simple even under the former conditions as might appear at first glance for the price of power not only may fluctuate from year to year but it also varies per unit with the amount consumed.

When the plant produces its own power the problem becomes decidedly more complex. It consists essentially in scheduling the expenses of the power department many of whose expense accounts are very similar to those already discussed. There is one, however, which deserves attention at present—the account for coal and other fuel. It will be found that the consumption of coal does not fluctuate gradually but is apt to make sudden jumps up or down. The reason is that it takes a certain amount of coal to get up steam and only a comparatively little more to materially increase the supply of power. After the economic limit of the boiler capacity has been reached, it is necessary to start another boiler and the whole process is repeated.

Scheduling Power Expense

In addition, the same situation holds true for the engines as well. It requires a certain amount of steam to run one at all, and after that the supply of power can be rather rapidly increased to a certain point and then it is necessary to connect up another engine. In the seasonal industry particularly it is desirable to have several well balanced units of boilers and engines in order to prevent overlapping and to eliminate the unutilized production of power. To schedule the power expenses with any degree of accuracy, it is necessary to have a definite production schedule as a basis and then the interpretation of that schedule in terms of units of power to be consumed.

Supplies are another item which often present certain difficulties. It should be remembered that there are two kinds of supplies. There are the usual general supplies employed in the current operation of the department. Past experience is perhaps the best guide in the scheduling of these expenses. It is rather important that the probable changes of price be forecasted for the products largely used as supplies as the figures are quite as necessary as the information in regard to the rate of consumption.

The other kind of supplies which have been called direct supplies are those which go directly into the product, but which for various reasons cannot be charged directly to the manufacturing orders. Such items as glue, enamel and screws are illustrative. The supplies follow the fluctuations in the volume of business about as closely as any charge which is not debited directly, and the schedule, therefore, can be worked out directly from the production schedule.

Wages and Salaries

Wages and salaries are important expenses in almost every department. Department heads and the company officers present no difficulties in this respect, unless bonuses are paid. Usually the latter depend on the net earnings of the business and hence should be charged directly to profit and loss as a distribution of profits and so do not need to be considered in the cost calculations. The rate of salary of these men is known in advance, and no matter how dull business may be they are indispensable and hence must be paid. Many of the office employees and sub-foremen in the factory are substantially in the same class.

When workers like inspectors, instructors, move-men, and the minor employees in the office departments are considered, the question is not quite so easy to answer. The number of such employees will vary as the volume of business varies but not in the same proportion exactly. However, if the production schedule is known a very close approximation to the amount to be paid them can ordinarily be made.

There are other expense accounts which have not been mentioned here which must be scheduled also, but space does not permit further elaboration. Enough has been said to indicate the methods which must be employed to accomplish the scheduling of the commoner ones, and in general the others follow much the same lines. There are one or two which should not be scheduled. Reclamation of errors is one of them. The manager may know that inevitably mistakes are bound to occur and that it will cost money to rectify them. It is very poor psychology, however, to schedule a definite amount. It has a tendency to make the employees think that they have an allowance for that purpose and that if they come within it they are really doing pretty well. The goal should be to eliminate such expenses altogether. The retainer accounts are another example.

The scheduling of expenses which has been discussed in the preceding paragraphs is on the basis of actual scheduled production, and its prime purposes have been pointed out. For the preparation of burden rates by any satisfactory method it is necessary to schedule exexpenses on the basis of normal production in order to obtain a ratio of normal expenses to normal production. Such elements as fixed charges will be the same for both schedules and many of the others can be developed at the same time quite conveniently. Of course, if the scheduled production is on the basis of normal plant capacity the two schedules coincide throughout.

The scheduling of expenses like all other efforts to foresee the future is of very great importance to the success of a business. Foresight, it is found, is not so much a matter of guess work as it is a careful analysis of past events and a thoughtful weighing of future possibilities in the light of such analysis.

Magnetic Inspection of Steel

IN A paper presented at the 26th annual convention of the American Society for Testing Materials, held at Atlantic City, June 26 to 29, 1923, a new method for inspecting steel by the use of its magnetic properties was presented by A. G. DeForest. By a suitable combination of two independent magnetic circuits, it has proved possible to determine the effects of two different factors entering into the treatment of steel. The method has been applied to a study of the different magnetic effects of the quenching and drawing processes on one per cent (100 point carbon) tool steel and 18 per cent tungsten high-speed steel. The apparatus has also been used in testing the hardness of cold-rolled steel irrespective of minor changes in the carbon content. The development of an accurate test which can be used commercially will increase the uniform behavior of tools and similar products and indicate the process of manufacture responsible for the undesirable changes which take place.

The outstanding advantage of the magnetic method of test lies in the fact that it is non-destructive. This is, however, not its only advantage. In magnetic testing, the effects of what appear to be the internal stresses concomitant to structural changes, are evaluated.

Taking, for example, a cutting tool which has been subjected to heat treatment, including both the quenching and drawing. A physical test, such as a hardness measure, will give a single factor-result and one which is not able to differentiate as between, for example, an overquench followed by an overdraw, or an underquench followed by an underdraw. It is, however, a characteristic of magnetic data that intermediate processes in thermal treatment leave a definite stamp on the material and subsequent treatment does not entirely efface the effects of an earlier step.

Effects of Thermal Treatment

It is the thermal treatment more than any other process, that causes the wide variation found in tools of commercially similar composition. An error of omission or commission in the quench or draw, or both, means decreased uniformity of production. A test method which serves to identify, even in part, that particular step in a thermal process in which the departure from routine procedure occurred, is of great value.

It is not pretended that the paper presented covers a complete research or offers a full solution. Since, however, the results are obtained by a method believed to be entirely new and one which has found successful commercial application during the past two years, it is felt that publication at this time will stimulate others in the field of magnetic inspection and facilitate the gathering of additional magnetic data.

Taking, for example, the testing of small case-hardened chains such as are used to prevent skidding on automobiles. Here the factors to be measured and guarded against are brittleness at one end of the scale and softness at the other. It is immaterial, from the point of view of acceptability, whether the chain is soft because of insufficient depth of case or from improper quenching. Both will give a soft chain.

At the hard end, a coarse structure with a moderate case reads higher than a similar case of normal structure. Hence the factors which make for brittleness read in the same direction and make a single measurement sufficient. If all other factors are constant, the magnetic reading is proportional to the depth of case. In the machine described by Mr. DeForest the sensitivity is adjusted and the zero is shifted, by changes in the circuit to give the same acceptance limits for all sizes. The use of this inspection method has enabled the manufacture of a much more uniformly acceptable product with practically no change in the production equipment.

This method permits of a rapid test with portable apparatus and commercial alternating current. A separation can be made between the effects of different variables which enter into the quality of the finished product. A single measurement can, under favorable circumstances, be adjusted to read the desired combination of several factors influencing a complex property, such as strength, hardness or brittleness.

Different Ways of Figuring Overhead

By John R. Godfrey

"Overhead" is one of the most overworked words in the English language and, like charity, it covers a multitude of sins. It is the alibi of high costs and high prices and many consider it an adequate excuse for all sorts of unnecessary expenses and careless management. And it's the greatest opportunity in the world for more self-delusion than anything I know.

"What's your overhead, Bill," asks Sam, "mine went up to 200 last month." "Don't see how you keep out of the sheriff's hands, Sam," Bill replies, "I never let mine run over 90." And neither of them knows just what the other means. Sam counts everything but labor and material as overhead while Bill's bookkeeper throws a lot of indirect costs in general expense.

Many count overhead just as Sam does, but use labor alone as the base line. Others count the same way except that they use labor and material added together, as the base. It's easy to see how it makes a heap of difference about the percentage, whether you take labor alone or count in material also.

There's one shop I knew of where labor was 16 per cent, material 55 per cent and overhead 29 per cent of the total cost of the product ready to deliver to the sales department. If you count overhead on labor alone it is 181 per cent, but if you use material and labor as a base, the overhead percentage drops to about 40 per cent, without changing the actual dollars you pay for supervision, insurance, etc., in the least.

Then there's the question of the kind of overhead. There's a heap of difference between overhead which simply adds to the total cost of getting out work, and overhead in the shape of new machines which not only reduces the direct labor costs on the work, but also reduces other indirect costs as well. A machine, for example, which enables one man to double his output per day, cuts the direct labor cost in two. It also doubles the output on the floor space occupied and reduces the costs all along the line.

It might help some if we studied costs separately instead of lumping them in one group. High machine overhead is usually a good sign, while clerical overhead may easily be an indication of wasteful management.

The real answer is the total cost of the article ready to be sold. Increased machine overhead is usually an economy, if you pick the right machines.

Book Reviews

Employment, Hours and Earnings in Prosperity and Depression, United States, 1920-1922. By Willford Isbell King, of the staff of the National Bureau of Economic Research. One hundred forty-seven pages, 6x9 in., cloth boards. Published by the National Bureau of Economic Research, Inc., 474 West 24th St., New York City. Price $3.10.

This book gives the results of an inquiry conducted by the National Bureau of Economic Research with the help of the Bureau of Markets and Crop Estimates and the Bureau of the Census for the President's Conference on Unemployment. The years 1920, 1921, and part of 1922 are covered in the report, and a picture is provided of industry in one boom and in one depression and in the transition period connecting them. The data were secured from questionnaires, types of which are shown. There are many statistical tables that will convey information in proportion to the amount of study expended upon them. The author has, however, made a thorough analysis and presents conclusions that are in themselves a summary of the statistics. That these conclusions are without bias is indicated by the fact that all reports of the Bureau of Economic Research must be approved, before publication, by the board of directors, twenty-one in number, representing widely divergent interests and points of view.

Mr. King gives a statement of eight ways in which knowledge concerning conditions of employment in the United States has been increased, by the report, and as they furnish a brief analysis of the book they are reproduced here:

1.—It shows the relative responsiveness of different industries to the forces giving rise to the business cycle.

2—It indicates the comparative ability of large and small scale business to resist such forces.

3—It analyzes the shifts of population from one industrial field to another.

4—It traces the variations in hours and earnings of employees that accompany the change from boom to depression.

5—It presents an approximately complete record of the seasonal changes occurring in the conditions of agricultural labor.

6—It gives a picture of the distribution of farm employees according to hours and earnings.

7—It measures the importance of part-time employment in the chief industrial fields.

8—It enables us to estimate the approximate total reduction in employment brought about by the depression of 1921.

Aluminum Repairing. By William H. H. Platt. Seventy pages, 5x7 in., cloth boards illustrated. Published by the D. Van Nostrand Co., 8 Warren St., New York City. Price $1.50.

A book giving detailed instructions on the repairing of aluminum sheets and castings and the attaching of copper, brass and steel to aluminum by tinning, sweating and burning, with sheet iron jigs.

The instructions are practical and complete. Anyone engaged in aluminum repairing will find the book a great help. Its size makes carrying it in the pocket convenient.

Motor Transportation of Merchandise and Passengers. By Percival White. First edition, cloth-board covers, 6x9 in., 486 pages, 76 figures. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $4.

A book giving an excellent perspective of a broad field is this volume that treats all phases of the subject of transportation by means of motor vehicles. Motor transportation is considered as a rapidly developing business activity, all branches of which should naturally be understood by those responsible for the direction of its work.

As stated in the preface, the book is addressed to those who for the first time are approaching the subject of commercial highway transportation, as well as to those who, although already versed in it, are anxious to find a presentation of other aspects of the question than those with which they are familiar. It should prove of practical guidance to those in authority in all phases of the motor transportation business.

The real value of the book lies in its scope. This volume is probably the first to treat merchandise and passenger transportation by motor vehicles in relation to each other and in relation to other methods of transportation. Economic phases are considered which often do not receive the attention of automotive engineers.

The vehicle, the road and the profitable operation of vehicles over the road are treated as factors of equal importance. The author sees great possibilities in co-ordinated transportation, as motor transport must bear a certain relation to the other means of transport already developed. Motor transport does not inaugurate a new era, as did the railroads, but it makes possible more complete development of the facilities of transportation. Networks of truck and bus routes are now developing.

One of the most important points put forth is the need for and growth of organization. It is stated that "we may expect to see transport companies of the future belonging to one of two classes: (1) Large companies with adequate capital and thoroughgoing organizations; (2) small companies which, though units, are so co-ordinated as to be virtually part of an association which thereby derives the benefits of good organization."

The problems that are the same for both trucks and buses are considered, as well as those that require a different solution for each type of machine. Among the latter are the subjects of vehicle design, maintenance, personnel, scheduling and routing, revenue, and legislative control. Road building and the broad subject of traffic regulation come in for treatment. The text is supported by charts and illustrations.

Probably the best idea of the subject matter of the book can be gained from the chapter headings, a list of which are here given: The Carriage of Goods, Truck Design and Equipment, Truck Maintenance and Service, Tires and Wheels, Trailers, The Truck and the Railroad, Truck Legislation, The Establishment of Express Lines, Terminals, The Truck on the Farm, The Truck and the Factory, The Truck and Raw Materials, Principles of Motor Truck Delivery, Delivery Applications, The Motor Vehicle in Public Service, Organization and Personnel, The Carriage of Passengers, Bus Transportation Problems, Bus Construction and Maintenance, Bus Operation, Taxicabs, Cost Accounting, Insurance, Traffic and the Highway, Highway Construction and Maintenance, the Economic Development of Highway Transport.

Trade Association Activities. Prepared by L. E. Warford and Richard A. May under the direction of Julius Klein with an introduction by Herbert Hoover. Three hundred and sixty-eight pages, 6x9 in. Published by the Department of Commerce and sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, $0.50.

By publishing this book dealing with trade association activities, the Department of Commerce has supplied a large amount of information concerning a movement which has taken on much acceleration during recent years and which has not been thoroughly understood by the public. It is believed that this book will do much to dispel the uncertainty as to the standing of trade associations which has been aroused by attacks upon them. In the course of an introductory statement, Commerce Secretary Hoover says:

"The constructive purposes of trade associations unfortunately have been confused with the minority of activities which have been used as a cloak for action against the public interest. It is also true that a vast amount of action in public interest has been lost and even great national calamities brought upon us by lack of co-operative action. All who know the situation in such matters realize that the problems of co-operative action are mainly the concern of smaller businesses. The material in this book has been brought together not from the point of view of educating big business, but with the idea that the legitimate trade associations and other forms of business co-operation are the real basis for promotion of smaller businesses.

"If we are to have a comprehensive economic system, it seems to me that the time has come when we should take cognizance of the necessities. The growing complexity of our industrial life, its shift of objective and service, requires the determination of an economic system based upon a proper sense of rightful co-operation, maintenance of long-view competition, individual initiative, business stability, and public interest.

"The trade association as a facility for the promotion and self-regulation of industry and commerce has become, by reason of its scope and activity, an important American business institution. There are several hundred organizations in the United States which clearly come within the strict definition of the term and more than a thousand others which undertake to perform some of the services rendered by the avowed trade associations.

"Notwithstanding the importance of this institution, as an economic factor, generally speaking, the American public is little acquainted with either the extent or the character of its work. The following pages undertake to present a picture of the organization, administration and operations of trade associations with a view to meeting the need for public information on the subject and further, in order that a business facility which is economically useful when properly conducted, may not suffer discrimination by reason of misapprehensions regarding its purposes and accomplishments."

Twenty years ago the public was only imperfectly informed as to the real objectives being sought by Chambers of Commerce and Boards of Trade. At that time the Department of Commerce produced a book defining those activities. At present the situation in regard to trade association activities is much the same. Among other things the book presents for the first time an exhaustive list of the names and addresses of trade associations. In addition, these associations are classified by commodities or service and by functions.

The chapter on the legal aspects of the trade association situation is of particular interest since it comes from Nelson B. Gaskill, of the Federal Trade Commission. It has been assumed that the Federal Trade Commission is not particularly friendly to the movement. In his chapter, Mr. Gaskill says:

"The trade association is not a combination in restraint of trade with one hand tied. It is not a medium for the exchange of business secrets, for the sole benefit of those who join in the exchange. It is not a new arrangement for the accomplishment of any object which needs, because of the law, to be pursued stealthily and in the dark. It is an expression of an interest common to all in any industry in which it arises, seeking to benefit the individual by bettering the entire industry and the public which the industry serves. It serves where the individual acts. It instructs where the individual learns. It works for the individual, but never instead of him. And while the attention of the individual may be focused on himself and his own interest, the aims, objects and ideals of the trade association are fixed in the wider field of the welfare of the whole group, the whole industry and the whole public dependent upon it." Mr. Gaskill concludes, however, with the admonition that the trade association must "hitch its wagon to a star."

Construction and Use of Automatic Screw Machines. Three hundred and fifty pages, 6x9 in., illustrated. Published by the Brown & Sharpe Mfg. Co., Providence, R. I., paper binding. Price, $1.

A very useful and complete treatise on Brown & Sharpe automatic screw machines combining construction descriptions, operation and adjustment requirements, and descriptions of tools and attachments. The book is well illustrated by photographs and diagrams and written in simple, clear language.

The first four chapters explain the various parts of the machine, their functions, give directions for proper erection and care, show how to set up the machine for a job, and how to make necessary adjustments. A description of standard tools and how to use them follows. This section has received special attention and the material is presented with particular care, the statement being made that "the success of the automatic screw machine in producing work with a high degree of accuracy, well finished and at a very rapid rate depends to a great extent on the selection and setting of the tools used."

The section devoted to the important matter of cam design and machining is of particular interest, as the standardized methods of cam figuring, machining and operation are carefully and clearly demonstrated. The use of practical examples is a feature of this section which will greatly assist the reader to a clear understanding of the principles governing the standard practice in the use of these cams.

The final chapter contains descriptions of special attachments, their use and how to set them up. Nearly a hundred pages at the back of the book are filled with belting diagrams, tables of approximate cutting speeds and feeds, and tables of data for figuring and machining cams. A comprehensive index is provided. The book is an important addition to the literature on this subject and will be welcomed by all who are interested in the operation of automatic screw machines.

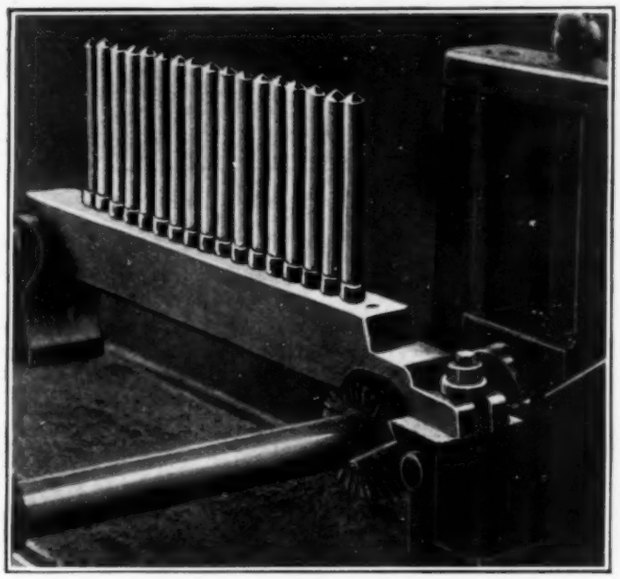
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Milling the Tangs on Taper-Shank Drills

BY FRANK AVEY

Not long ago the manager of a small shop that makes special drills in considerable quantities, showed me a simple fixture for holding taper-shank drills while milling the tangs. The fixture shown in the illustration consists of a bar of machine steel in which seventeen



MILLING THE TANGS ON TAPER-SHANK DRILLS.

holes have been drilled and taper reamed to receive the turned shanks of the drill blanks. The ends of the shanks project far enough through the bottom of the bar to allow the two milling cutters to machine the tangs at one pass. The drill blanks are lightly driven into the taper holes with a mallet, and are removed the same way, after the holding bar, which is hinged on one end, is swung up away from the cutters.

With this type of fixture no trouble is ever experienced with chips, as they immediately drop down onto the table out of the way. The tangs are also always milled in the same relation to the taper shanks provided the operator keeps the dirt out of the holes and off the shanks when inserting the drill blanks

Floating Holders for Reamers

BY J. T. TOWLSON
London, England.

As a machine shop foreman, responsible for the accuracy of the work produced by the men under my direction, I must confess that I am no ardent advocate of floating holders for reamers, particularly when accuracy of product is imperative. Perhaps a short account of an actual experience will serve to show why.

Certain details of work were required to be bored to what is called in shop parlance a "wringing fit" to the 1-in. plug gage. The price was close and a considerable number of pieces was required. We were provided with reamers and floating holders which the management confidently expected would insure making the holes all of the proper size. These reamers and holders were used on various engine lathes by different men, with the result that there was a variation of several thousandths in the size of the holes produced; none of them being *under* size.

The product of all the turners except two was spoiled. These two—old experienced men—completed their work with holes that were "dead to size." Upon investigation it was found that these men were afraid to risk their reputations by using the floating contraptions and had carefully laid them aside while they bored their holes to within a few thousandths of size and finished them with hand reamers in the regulation manner. Notwithstanding this, their output was fully up to that of the workmen who had used the floating holders, presumably for increasing the output.

Neither the management nor myself were satisfied with the condition, however, as accuracy and high output depended almost entirely upon the unusual degree of skill possessed by these two men. The floating reamers were abandoned and reamers having a forward pilot, working in a hole ground in position in the lathe spindle were substituted, carrying the job through with the necessary degree of accuracy.

Floating holders for reamers are, it would appear, a sort of sop to the presumed inaccuracy of alignment of head and tail stocks and if such misalignment really exists, and varies with different lathes, how is it possible to ream a hole that will compare in accuracy with that produced by a reamer that precisely co-ordinates with the geometric axis of the spindle?

This reasoning, supported by experience, has inclined me to abandon the use of the floating holder for reamers, for it is my firm conviction that if the head and tail stock are dead in line, no floating compensation is necessary, while if they are *not* in line no scheme of floating holders will compensate for the error.

A Quick Method of Pointing Pins

BY R. H. KASPER

A large number of small pins were to be formed to a point on one end. As the work did not require great accuracy it was not considered advisable to use a lathe for the purpose. Instead, the work was done quickly by grinding in the following manner: A piece of round stock was drilled on one end so that the pin would turn freely in the hole and also extend beyond the end of the rod. By placing a pin in the hole and holding it against the edge of an abrasive wheel the friction caused the pin to turn, grinding an even point on the end.

Babbitting Large Bearings by Centrifugal Machine

By Frank C. Hudson

In order to secure dense metal in the babbitted bearings used on machinery of various kinds, the General Electric Co. has built a centrifugal babbitting machine for bearings 12 in. and larger in diameter, as shown in Fig. 1. The machine consists of two heads, each with a chuck-carrying spindle, and both driven by the same motor. The head *A* is adjustable, so as to accommodate bearings of different lengths, and also to permit the loading of the chucks and the removal of the completed bearing. The bearing is held in the two chucks, which are tied together by tie rods as indicated.

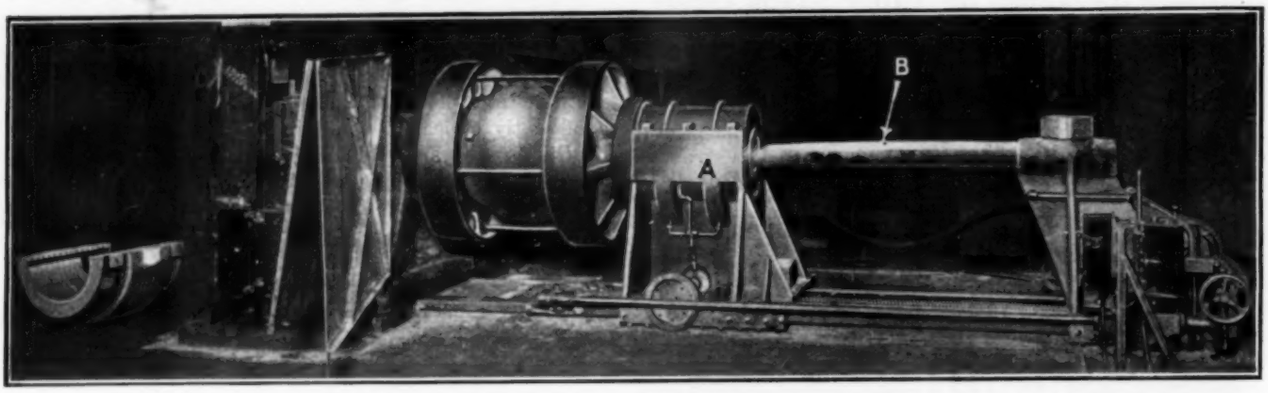


FIG. 1—CENTRIFUGAL BABBITTING MACHINE FOR LARGE BEARINGS

The bearing is first preheated to almost the melting point of the babbitt. The babbitt is then brought to a slightly higher temperature than is the usual practice, and introduced into the bearing shell through the trough *B*, which is pushed through the hollow spindle of the head *A*, so that the highly heated babbitt runs directly into the revolving shell. The peripheral speed of the bearing is set at about 1,200 ft. per minute for all sizes, and has been found to give excellent results in securing a dense metal.

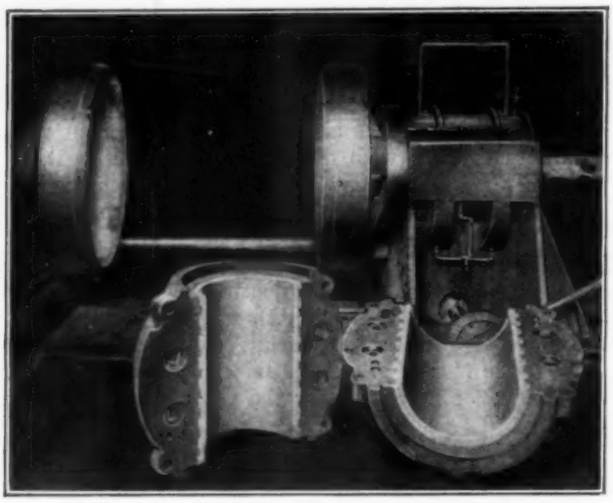


FIG. 2—DETAILS OF CHUCKS AND BABBITTED BEARING

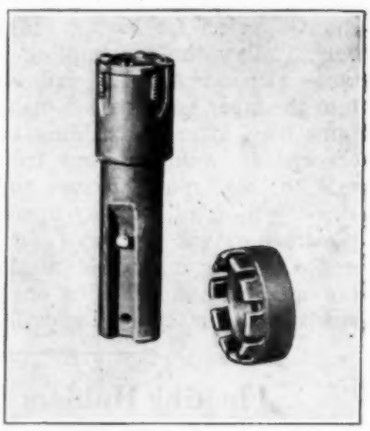
It takes about 3 hours to complete the babbitting of a 12-in. bearing, this time including the chucking of the bearing shell, putting in the tie rods and preheating the bearing. The actual running time of the machine is from 5 to 7 min., depending on the size of the bearing being poured. It is, of course, necessary to predetermine the amount of metal to be poured inside the shell, in order to secure a lining of the proper thickness.

Fig. 2 shows a more detailed view of the head of the machine, together with a large bearing which has just be babbitted. It will be noted that the babbitt is held in place by dovetailed grooves running around the periphery, as is customary in many plants. Babbitt linings cast in this way have a uniform density at all parts of the shell and do not require peening.

A Non-Stripping Tap

By Tom O'Reilly

The tap shown standing on end in the illustration has a feature that is as simple as it is handy. The tap is for use in the turret lathe, but instead of being clamped in, as is the usual method, the setscrew in the turret is screwed down until the end just clears the bottom of the slot shown in the shank of the tap, so that the tap can be moved in and out by hand. When the operator is starting the tap into the work, of which a sample is shown alongside the tap, he feeds the turret forward so that the setscrew engages the pin shown in the bottom of the slot and thus forces the tap into the work. After the thread has been started, the pressure is released and the tap feeds itself through the turret, being fed along just enough to keep the tap in place. The scrap due to stripped threads has been greatly reduced by this method. Another important feature is that the tap does not have to be backed out of the hole. As soon as the last thread of the tap is through the work, the work is removed from the chuck and the tap is pulled through and slipped back into the turret.



A NON-STRIPPING TAP

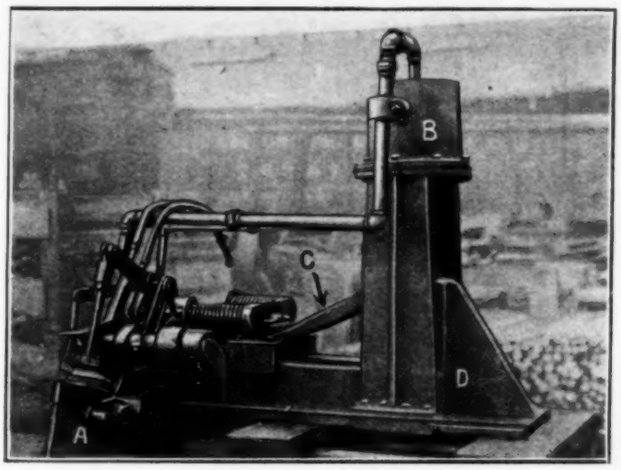
The photograph was taken in the shop of the Triangle Tool & Pattern Co., Detroit, Michigan.

An Unusual Bolt Header

BY CLIFFORD H. FRENCH

The bolt header shown in the accompanying illustration was found in the yard of a dealer in second-hand machinery of all kinds in Aberdeen, Wash., not very long ago. It is of unusual design, and, unfortunately, bore no name plate or other distinguishing mark. It was evidently operated by compressed air, which probably ties it up with some railroad shop, where it had probably been built in an emergency and had finally given way to a more powerful or more efficient machine.

The bolt to be headed is clamped by means of pressure exerted by the air cylinder *A*, which is unmounted from its trunnion bearings. The pressure for heading is obtained from cylinder *B*, which operates a sort of crosshead hidden behind the broad upright supporting the cylinder. Power is transmitted to the heading dies by means of the toggle shown at *C*, the heavy abutment *D* taking the thrust of the toggle and keeping the cross-



AIR OPERATED TOGGLE JOINT BOLT HEADER

head in line. The heavy springs shown return the dies when the air pressure is released in the cylinder, so that the finished piece of work can be removed and a fresh piece put in place ready for forming at the next stroke.

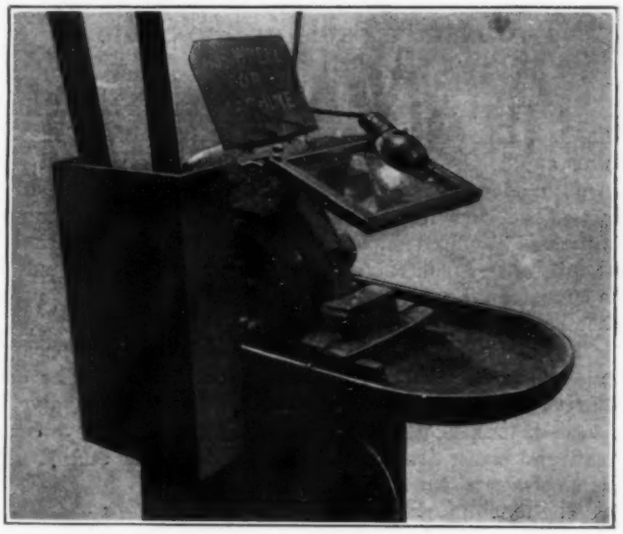
The various air connections are shown quite clearly at the left.

Guarding the Grinder's Eyes

BY MILTON WRIGHT

The question of goggles—to wear, or not to wear—has long been the subject of vexatious dispute wherever grinding wheels are used intermittently, as for sharpening tools in the machine shop. There can be no doubt that the safety of one's eyes is assured by wearing goggles when grinding a lathe or planer tool but, unless under very exceptional circumstances, the number of men who will "take a chance" is still far in excess of that of the more cautious and conservative ones.

The scheme shown in the accompanying illustration is by no means new, neither is it anywhere near so widely used as it ought to be. It demands no extra movements of the operator, takes none of his time, and does not obstruct his vision. He will, instinctively and without question, take advantage of the protection it affords.



GUARD FOR GRINDING WHEEL

A pane of glass of generous size, a suitable frame made up of scrap materials, and a couple of bolt holes tapped into the hood of the machine are about all that is required. The cost is negligible—less than that of the average eye accident—and every tool-grinding machine should be so equipped.

The electric lamp shown in the picture is not in the right place. It should be under, not above, the glass in order to avoid reflections.

Old Hay Press with Hand-Cut Wooden Screw—Discussion

BY WALTER G. ELLIOTT

I have noted with interest the article under the above title by H. E. Crawford, on page 706, Vol. 58, of the *American Machinist*. During the great war, in Palestine, I discovered by accident an underground cave at a small village in the Judean Hills outside Jerusalem, and in it was an old wooden olive press as shown in the inclosed photograph. Our Padre, with the aid of an interpreter, made inquiries and discovered from the oldest inhabitant that its exact age was not known but that it dated back many hundreds of years. The screw is entirely of wood and about 8 in. in dia. Though the threads show signs of wear, I think you will agree that it is still very clearly defined. I agree with Mr. Crawford that many of us would be stumped to do such jobs today and especially under the conditions existent at the time the screw was made.

HAND-CUT WOODEN SCREW IN AN OLD OLIVE PRESS

Two Handy Tools on the Sante Fe

By Chas. F. Henry

The Sante Fe repair shop at San Bernardino, Calif., has a number of interesting devices, two of which are illustrated herewith. The first is a hand-operated hydraulic arbor-press, as shown in Fig. 1. It consists of a crosshead carrying the hydraulic cylinder and plunger, which is mounted on the uprights shown. The base is a substantial iron casting, the whole being supported on a convenient wooden cabinet in which various appliances are kept.

Power is applied by the hand lever *A*, which operates the pump used in forcing down the piston. The coil spring *B* returns the plunger when the release valve is opened, making the press quick acting. The overhead rail and chain are for supporting the outer end of any long pieces of work which may require it.

The machine shown in Fig. 2 has been built especially for milling the keyslots in crossheads and piston rods. The pieces to be milled are mounted on the V-blocks at *A*,

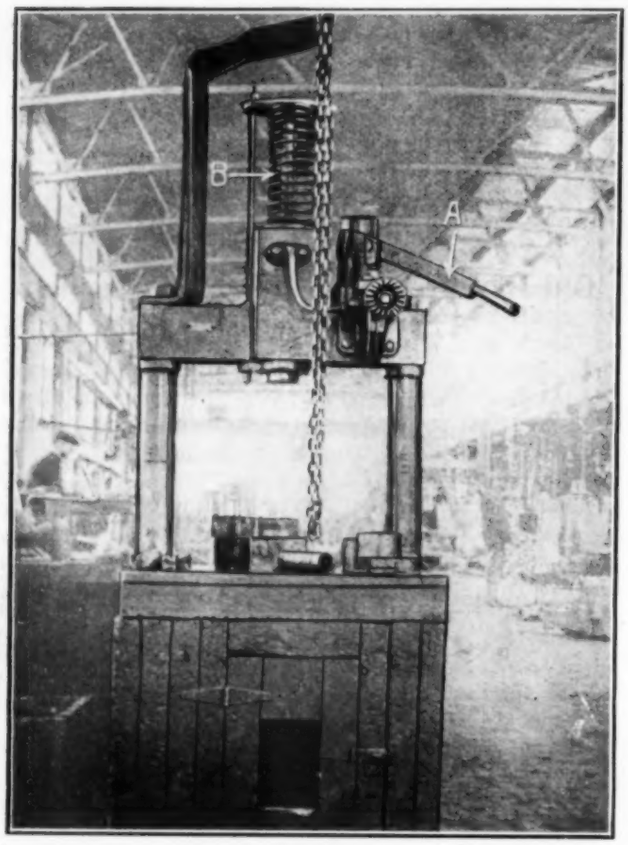


FIG. 1—HAND-OPERATED HYDRAULIC ARBOR-PRESS

so that the starting holes for the slots are in a vertical position and in line with the spiral milling cutter *B*. The cutter is fed through the starting hole by a screw and hand wheel *C*, until a pilot on the lower end of the cutter enters a supporting bushing, which is part of the vertical frame.

With the milling cutter in position, the flanged pulley *D* is in line with the larger pulley *E*, which drives the feed screw for moving the table with its work, in the direction of the cut. The feed belt is put in place after the work and cutter are all set for milling. The crank *F*, is also provided, so that the work may be quickly moved to any desired position, or for hand feeding at any time. It will be noted that power for driving the milling cutter is supplied by the air motor *G*, as is very common in railroad practice. The motor is kept from turning by the two uprights.

Both of these views also give a good idea of the construction of the shop of the Atchison, Topeka & Sante Fe Railway and it will be seen that it differs considerably from the old type of railway shop building. They show

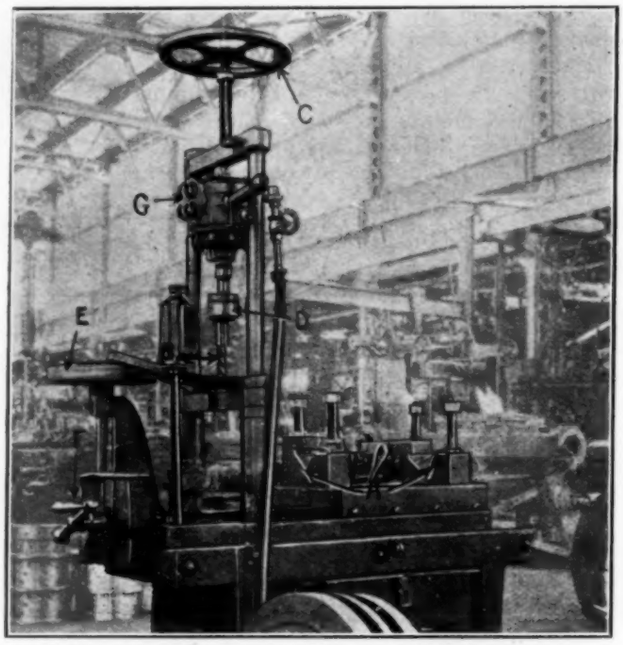


FIG. 2—MACHINE FOR CUTTING PISTON-ROD KEYWAYS

one of the high bays which is provided with traveling cranes sufficiently heavy to handle any work of this department. The windows on each side of the monitor roof give good light and aid in securing proper ventilation. This shop is one of the newer buildings of the Sante Fe, this road being keenly alive as to the need for modern shop buildings.

Two Ways of Making a Core—Discussion

By M. E. Duggan

On page 308, Vol. 58, of the *American Machinist* there appeared an article under the above title by F. C. Edwards of Birmingham, England, in which Mr. Edwards professed to be "astounded" by some remarks that I had made in an earlier contribution; especially at my expression of doubt as to the ability of the average patternmaker to predetermine the operations of the molder and my statement that the word "proper" does not appear in the patternmaker's dictionary.

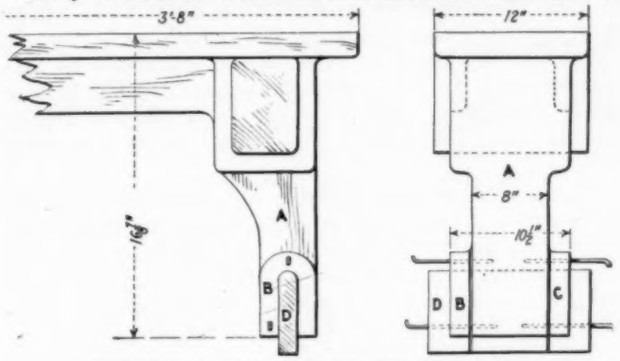
There was nothing in my remarks to cause consternation. The patternmaker whose early training in molding and core-making practices has been neglected is poorly fitted to predetermine the operations of men in these departments, and the acquisition of knowledge of the above-mentioned practices after he has reached the status of a journeyman is an up-hill task indeed.

Not long ago my attention was directed to a pattern, a section of which is shown in the accompanying sketch. It was well made and nicely finished, but the maker thereof was evidently not familiar with a certain detail

of molding practice or he would not have overlooked the difficulty of setting the core *D* in the mold after the pattern was withdrawn.

The loose pieces *B* and *C* were intended to be drawn "out and up" after the pattern was removed. Then the question arose: how was the molder to insert the one-piece core *D* through the narrow part of the mold at *A* and get it down into place at the bottom.

Many foundries would have considered this an in-



SETTING A CORE UNDER DIFFICULTIES

excusable mistake and would have returned the pattern to the maker for correction, but in this case the molder overcame the defect and set the core in three sections as the sketch shows.

The end sections were set first by lowering them to the bottom of the mold and sliding them endwise to their respective places. The middle section was then set and secured with chaplets placed at each side between the core and the mold. The core was made more secure by passing nails through the middle section into the end sections.

All this was of course a waste of time and labor, which waste would have been obviated by making the pattern correctly in the first place. The molder also took a long chance on the production of the casting, especially when its size and weight are considered.

A Few Lathe Kinks

BY HERBERT F. CRAWFORD

When it comes to utilizing space efficiently, it is hard to beat the small experimental shop of Burr Struble in Portland, Ore. And, as is usual in such shops, there are many interesting little kinks which can be of service elsewhere.

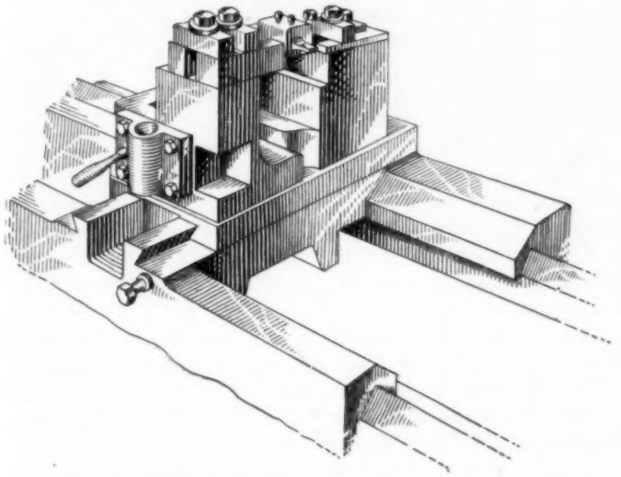


FIG. 1—SPECIAL TOOL BLOCKS ON CROSS SLIDE

One of these is the way in which a small engine lathe is used for such jobs of repetition work as occasionally come into such a shop. Two special tool blocks are mounted on the cross slide, as shown in Fig. 1. These tool blocks perform in about the same way as those on the cross slide of a hand screw machine, the cutting-off tool being in the rear tool post as usual. It will be noted that the front tool block carries two tools, and this arrangement can, of course, be varied to suit the particular work in hand. As shown, there is an outside turning tool and a counterboring and facing tool that overhangs.

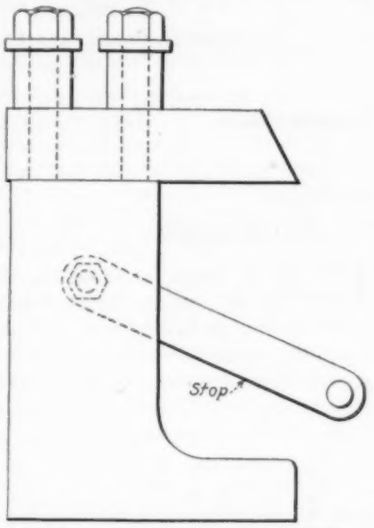


FIG. 2—STOP FOR LOCATING STOCK

In addition to the cutting-off tool, the rear tool block carries a stock stop on one side. This stop, as shown in Fig. 2, drops down out of the way after the stock has been located for position.

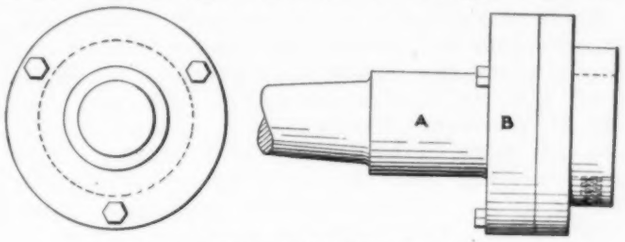


FIG. 3—SMALL ECCENTRIC CHUCK

Having quite a number of small eccentrics to turn in a bench lathe, Mr. Struble made the chuck shown in Fig. 3, which requires very little explanation. The shank *A* which fits into the lathe spindle carries a front portion *B*, that can be adjusted to the small amount of eccentricity desired, and locked in this position by the screws shown. Duplicate eccentrics can be made without difficulty by means of this device.

A very convenient little collet which can be used directly on the nose of the lathe spindle is shown in Fig. 4. If the spindle is not provided with the sharp taper necessary it can be bored, or if the spindle has a large hole through it, a bushing can be used. The main object, however, is to avoid the necessity for using a draw-in rod through the spindle, the chuck being closed by means of the nut *A* on the front end.

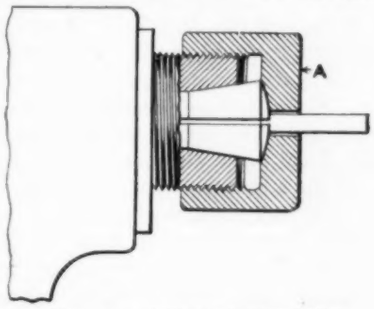


FIG. 4—A COLLET WITHOUT DRAW-IN ROD

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors
July 26, 1923

Analyzing the Overhead

THERE is much loose talk about overhead and, unfortunately, much of the keeping of accounts with regard to it is done in the same loose way. Often everything except direct labor is lumped into overhead, and practically no attention paid as to what items go to make it up.

Every shop pays more or less attention to the items which go to make up direct labor, probably because the pay roll has to be met at regular intervals. They analyze operations and leave no stone unturned to reduce the cost of individual operations to the minimum. But it often happens that indirect labor costs creep up without being noticed. A new clerk here or there, additional card systems and many other items, all help to make up a total which entirely offsets many of the small savings in the shop.

It will probably pay almost any concern periodically to go over its overhead expenses and analyze them very carefully. All items which are not directly productive should have the same careful scrutiny as is given shop costs, if not more. Taking the cost of gages for example, it might be well to find if the gaging system itself was right. Does the man who designed the gages, or who laid down the tolerances, thoroughly understand the most modern gaging methods? Has he required special gages in cases where standard gages would have served the purpose if he had understood the use of unilateral tolerances?

These are only a few items to look after, but it may be found that much that now goes into overhead can be reduced in volume, and the lowering of indirect costs is healthy from every point of view.

What Is Good Design?

ONE OF THE most consistent performers at meetings of the Society of Automotive Engineers came through as usual at the recent meeting of that association. We have not attended an S.A.E. meeting for a long time without coming away with an idea for an editorial from something said by Henry M. Crane. It may have been some drily humorous comment brought forth by a discussion or it may have been some carefully thought out point made in the course of an address.

This time it was an off-hand statement of the designer's ideal. "The utmost simplicity is the acme of good design." Here is a thought that might well be framed and hung in every drafting room for certainly there is much machine design that is far short of Mr. Crane's "acme."

Few designers, of course, expect to achieve the ultimate in simplicity or any other feature in their first designs. Compare the automobile of fifteen years ago with the motor car of today. Then it wore most of its works on the outside. They were easy to get at, it's true, and that was sometimes necessary because of the uncertainty of their functioning. Today such things as lubricating systems are built into the engines where they are more nearly dirtproof and foolproof.

The old engines were much more impressive as mechanical contrivances to awe the uninitiated but from a design standpoint they were far from the beautifully compact and protected units found in most modern cars.

Simple designs are desirable for other machines besides motor cars and where competition has been keenest and production greatest the best results are usually to be found. In most fields, however, the utmost in simplicity has not been reached. The designers, therefore, may well take Mr. Crane's terse definition as a standard to reach for. Not only will its achievement mean engineering advancement but increased sales as well, for most of us appreciate the beauty of simplicity and are attracted to it even to the extent of paying for it.

Rewarding the Plugger

THERE is never much of a problem about rewarding the genius whose brilliancy sticks out by some stroke of invention or system, and makes an impression on the multitude. These men are usually in sufficient demand so that they can almost name their own salary, and get it. And yet there are many cases where men of this kind have, for one reason or another, left the concern and still the business went on much as before.

The plugger is a different proposition. He isn't brilliant or he wouldn't be a plugger. But he very frequently knows his job so thoroughly that it is difficult to replace him if, for any reason, he leaves. He is skilled in his particular line and there are none too many of that kind. He rarely makes a demand for more pay, because he isn't built along the genius line. And yet no business can get along with all geniuses and no pluggers. The pluggers are really the ones that keep the ship afloat.

The genius has many brilliant ideas, but being a genius, he is temperamental and you never know whether he will be on the job two days a week or six. And he is very apt to be out seeking inspiration just when you need him most.

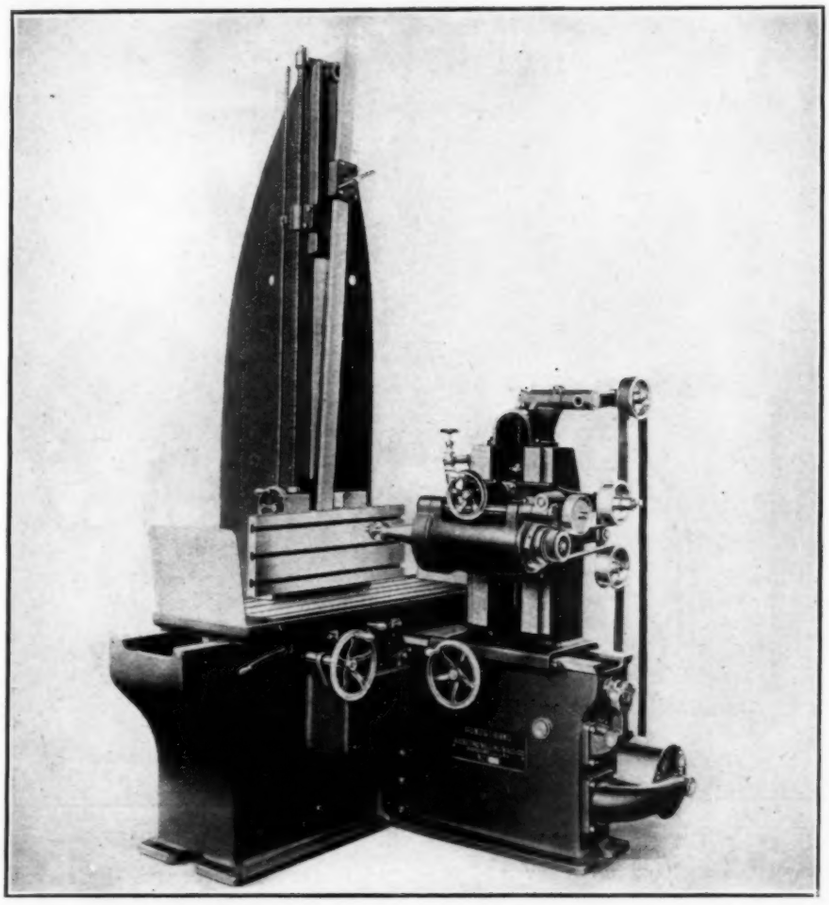
The plugger on the other hand is always on the job. You know he will be there the next morning and that any special shipment will go out on time. He is dependable in every way, that's because he is a plugger. And dependability has a very definite value to any business, even though it is not easy to measure in dollars and cents.

The plugger deserves more consideration in the way of rewards, either in cash or in some other method of payment, than he usually receives. For without the plugger we would have a hard time keeping any business steadily on its forward way.

Shop Equipment News

Sundstrand Radius, Internal and Surface Grinder

Of particular interest to the railroad or general purpose shop is the Sundstrand heavy duty radius, internal and surface grinder, recently placed on the market by the Rockford Milling Machine Co., Rockford, Ill. The principal feature of the machine is the pendulum motion for such work as grinding locomotive radius links, but the machine is easily converted for internal and surface grinding by swinging the pendulum out of the way, or removing it. The pendulum mechanism is independent of the rest of the machine.



SUNDSTRAND RADIUS, INTERNAL AND SURFACE GRINDER

A standard spindle is furnished for radius link grinding and light surface grinding, and can be adapted for internal grinding by a planetary motion, imparted through gearing which is adjustable in the spindle head while in motion. For heavy duty work a heavy grinding spindle will be furnished on order.

The base is made from two heavy castings and has bearing surfaces for the horizontal table and the spindle column. At the back of the base is bolted the vertical column for the radius bar, which also serves as the motor bracket when the machine is arranged for motor drive. This construction is evident from the illustration.

The link radius is adjustable by means of a handwheel to any length between 18 in. and 100 in. For radius grinding the work is held on the 12 x 36-in. vertical table, which is secured to the radius bar and given its oscillating motion through the horizontal table. The horizontal table measures 16x48 in. and has a 50-in. longitudinal motion through hand or power feed. The oscillating motion is automatically controlled.

The spindle column has a maximum horizontal movement of 14 in., controlled by hand, but power feed can be furnished. The spindle head has a vertical adjustment on the column of 20 in. The spindle is mounted in ball bearings in such a way that, it is stated, the wear can be taken up by a single nut. Sleeves of different sizes may be applied, and the mechanism for imparting a planetary motion to the spindle is also contained in the housing. The planetary adjustment, with a throw of $\frac{7}{8}$ in., permits grinding a hole $1\frac{3}{4}$ in. larger than the diameter of the wheel.

Motor drive is recommended and a motor of $7\frac{1}{2}$ hp. at 1,200 r.p.m. is required. An oil pump for cutting coolant is regularly furnished, together with necessary tools and splash guards. Special fixtures and attachments will be made on order.

The total height of the machine is 12 ft. 2 in., and the floor space required is 81 x 114 in. The net weight is 6,800 pounds.

O-Z Direct Reading Tachoscope

A combined anti-magnetic chronometer and revolution counter, called the O-Z direct reading tachoscope, is now offered by O. Zernickow, 15 Park Row, New York, N. Y. The standard time unit adopted for this instrument is 6 sec. and, in this time, accurate readings of r.p.m. or, using the disk wheel supplied, ft. per min. may be secured.

The operation of the tachoscope is simple, as it is necessary only to hold the spindle against the revolving shaft, press the push button and let it fly back. When the pointer of the indicator comes to rest, the r.p.m. may be read directly from the dial. The operation of the push button sets

the counting mechanism at zero from the last reading and winds the watch movement. It is, therefore, unnecessary to reset the counter after each reading, since the last reading remains on the dial until the instrument is positioned for a new reading and the push button depressed. A colored disk on the dial of the counter indicates the direction of rotation and the set of graduations to

O-Z DIRECT READING TACHOSCOPE

be used. Left hand rotation and the use of the red graduations are indicated by a red disk, and the color of the right hand disk and graduations is black. One revolution of the large pointer indicates 1,000 r.p.m., or 333⅓ ft. per min. if the measuring wheel is used; and 10,000 r.p.m., or 3,333⅓ ft. per min., are indicated by one revolution of the small pointer.

The diameter of the dial is 2 in. and the net weight of the instrument is 6 oz. A carrying case, 4½ x 3 x 1¼ in., is furnished together with a rubber point, a funnel center and a measuring disk, as shown in the illustration.

It is said that the instrument is designed to stand up to 30,000 r.p.m. and is fitted with pivots and bearings suitable for such speeds.

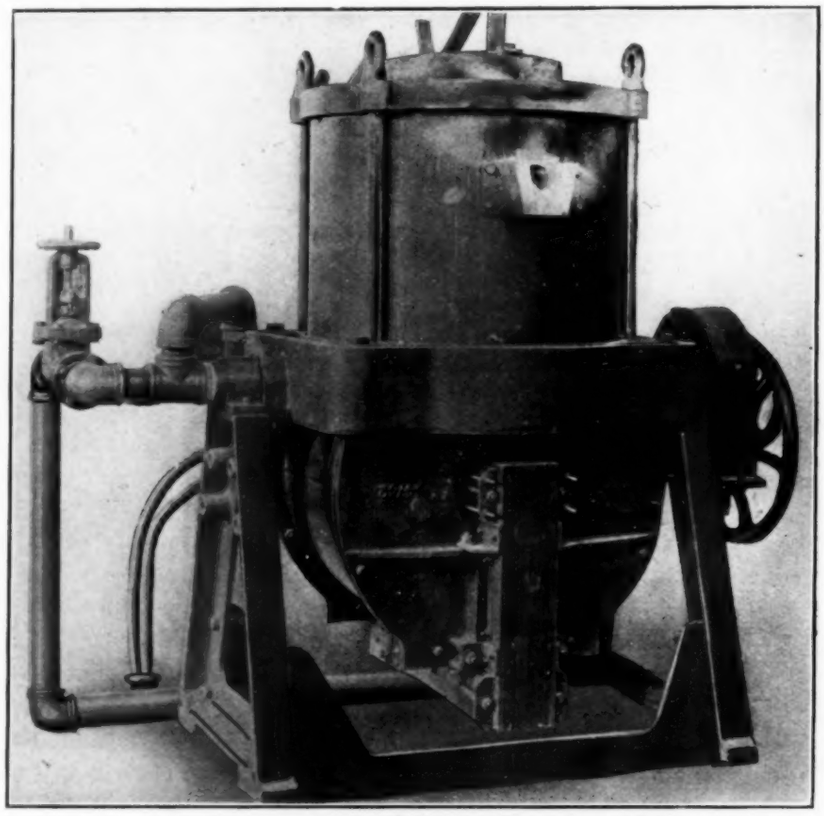
G. E. Induction Furnace for Melting Non-Ferrous Metals

A development in induction-type furnaces has recently been made by the General Electric Co., Schenectady, N. Y., and is illustrated herewith. This furnace is particularly adapted for melting non-ferrous metals.

The melting chamber, at the top of the furnace, resembles an ordinary crucible, and has a charging door on one side and a pouring spout on the other. There is also a door in the cover which may be used for charging or for a vent. Distinct from this chamber, but communicating with it through ports, is another chamber, in the form of a hollow cylinder, encircling a primary winding and one leg of a laminated core. Molten metal in this secondary chamber constitutes the secondary of a transformer and the heat in the furnace is generated by the secondary current which flows around the cylinder, through the resistance of the molten metal, when alternating voltage is applied to the primary winding. The secondary chamber is located below the melting chamber.

An important feature of this furnace is a positive circulation between the melting chamber and the heating chamber effected by the magnetic force of repulsion, which exists between primary and secondary in the transformer. An axial displacement of the primary, relative to the secondary, causes the fluid pressure due to this force to be greater at one end of the secondary cylinder than at the other. The molten charge flows from the end under higher pressure to the melting chamber, with a return flow from the chamber to the other end of the cylinder.

The furnace lining is constructed of refractory parts, previously formed and fired, assembled with cemented joints in the furnace. This construction decreases time and expense of replacement and permits inspection prior to assembly. The lining is surrounded by layers of heat-insulating material. Since the secondary chamber must be full of molten metal when starting, the furnace is at its best when operating continuously on the same kind of metal. When melting intermittently, the residual charge must be kept in a molten condition between heats by applying a low voltage sufficient to supply the radiation losses. When the furnace has been completely emptied, a priming charge of molten metal must be placed in the secondary chamber before starting.



G. E. INDUCTION FURNACE FOR MELTING NON-FERROUS METALS

It is stated that the furnace has been used on red and yellow brass and on copper with pronounced success. For yellow brass, the furnace illustrated has a total holding capacity of 1,200 lb. and a pouring capacof 750 lb., and this capacity can be poured each hour with an input of 75 kw. which gives a power consumption of not over 200 kw.-hr. per ton. Intermittent operation increases

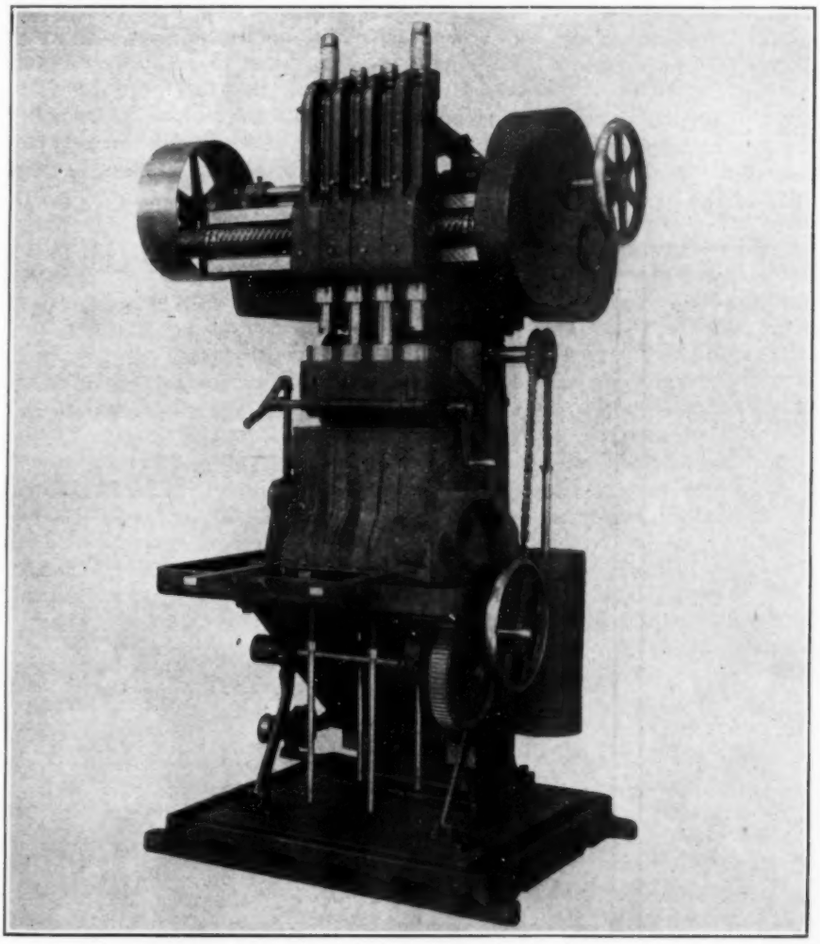
the power required by the amount necessary to supply the radiation losses during standby periods. The metal loss is less than 1 per cent.

The furnace proper is mounted on a strong frame which is provided with trunnions supported in bearings on pedestals. The form of furnace illustrated revolves about its approximate center of gravity when pouring, and another form is arranged to rotate about a line passing through the pouring spout. The former is tilted by means of a handwheel and gearing, the latter by means of a motor controlled by a standard drum switch that gives rapid and easy operation.

Moline Cylinder Lapping Machine

For lapping the bores in automobile cylinders, the Moline Tool Co., Moline, Ill., has recently developed the machine shown in the accompanying illustration. This machine is designed along the same general lines as the Moline "Hole Hog" multiple drilling and boring machines, the principal difference being that the spindles can be reciprocated vertically at any desired speed while rotating.

The machine is strongly built, in consideration of the heavy class of work upon which it is intended to operate, but it is, at the same time, comparatively simple in design and easy to operate. The machine shown in the illustration is built with four heads, but heads can be supplied for any number of cylinders. Each spindle is encircled by a bronze spiral gear, and all the gears mesh with, and are driven by, a horizontal spiral in the cross rail of the machine. Power is delivered to the horizontal spiral through a set of slip gears which can be changed when it is desired to change the spindle speed of the machine. Any desired speed of revolution or reciprocation can be obtained. A ball thrust bearing at either end of the spiral minimizes both friction and wear. The reciprocating motion is imparted to the spindles by the use of a crankshaft and connecting rods from the same kind of motor as that for which the cylinder is intended, in order that the same stroke may be obtained. The length of the stroke can, however, be changed as desired.



MOLINE CYLINDER LAPPING MACHINE

The machine is built with a stationary rail and a table that slides vertically, the table being counterbalanced so that it can be easily raised. In the machine illustrated, the table is elevated by the use of a hand wheel which operates a set of spur gears and a rack pinion, but power elevation can be supplied if desired. To operate, the cylinder block is mounted on a fixture on the table, which is then raised, with the laps entering the cylinder bores, to a point high enough so that the laps will operate in the spaces traveled by the pistons. Work can be changed quickly and easily. A set of adjustable supports underneath the table of the machine prevents the table from being lowered beyond that point which is most convenient for the operator.

The spindles are of a fine grade of steel and are hardened and ground. All bearings are of bronze, and oil cups are so situated that ample lubrication is assured. A pump and piping for supplying oil to the cylinder bores is furnished with the machine. The necessary holding and locating fixture is also standard equipment, and honing or lapping tools will be supplied if desired. A clutch pulley makes it possible to drive the machine from a lineshaft or countershaft, or direct from a motor, as desired. The floor space required is 5 ft. square and the net weight of the machine is 6,200 pounds.

"Viscolac" Finish for Wood and Metal

A new material, which is known as "Viscolac," has been developed by E. I. Du Pont De Nemours & Co., Wilmington, Del., and is now in use in many wood- and metal-working industries including the manufacture of automobiles and furniture.

"Viscolac" is a pyroxylin solution, which is developed from cotton, and provides a finish for wood and metal which, it is said, is so durable, tough and hard that it will resist high temperatures, hot or cold liquids and soap and water. It does not readily chip or crack and air-drys very quickly.

St. Louis Roller Bearing Belted Motor-Driven Grinders

The St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo., has recently made improvements in its line of grinding and polishing machines. Roller bearings are now available for the spindles, as well as babbitt and ball bearings, which were formerly supplied. Roller bearings can be furnished on the Nos. 7, 8, and 10 polishing machines, such as shown in Fig. 1, and also illustrated on page 780, Vol. 55, of the *American Machinist*. The Nos. 7, 8 and 9 grinders of the type illustrated in Fig. 2 can also be fitted with roller bearings. There are four bearings, two located close to the wheels and two close to the driving pulley. The construction is such that the parts can be easily disassembled for inspection of the bearings.

Both the polishing and the grinding machines can be arranged with motors mounted overhead for individual drive. A bracket is bolted to the rear of the pedestal and arranged to carry the motor so that it is out of the way of the operator. Means are provided for keeping the belt tight. The advantage of the arrangement is that the motor is removed from the dust and grit which is apt to be encountered at the spindle of the machine. It is in such a position that it can be easily kept cool and is always open for inspection, which would not be the case with a motor mounted directly on the spindle and completely inclosed.

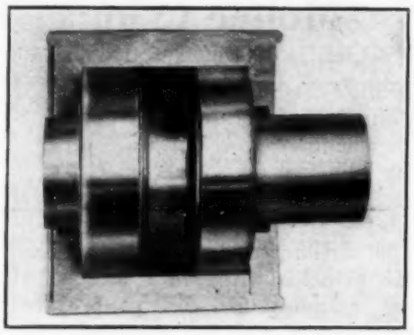
Belt guards of the type shown in the accompanying illustration can be furnished, or the top of the column may be completely closed if it is desired to drive the spindle by belt from a shaft below the floor. The machines can be furnished with both tight and loose pulleys mounted on the spindle when it is desired to drive directly from a lineshaft. In this way the spindle can be stopped when the operation of the machine is not required.

This type of drive can be employed on practically all sizes of machine, although it is here shown adapted to a large unit. On page 860, Vol. 55, of the *American Machinist*, a similar type of drive applied to a small grinding stand was illustrated, which shows the adaptability of the arrangement.

St. Louis Roller Bearing Loose Pulley

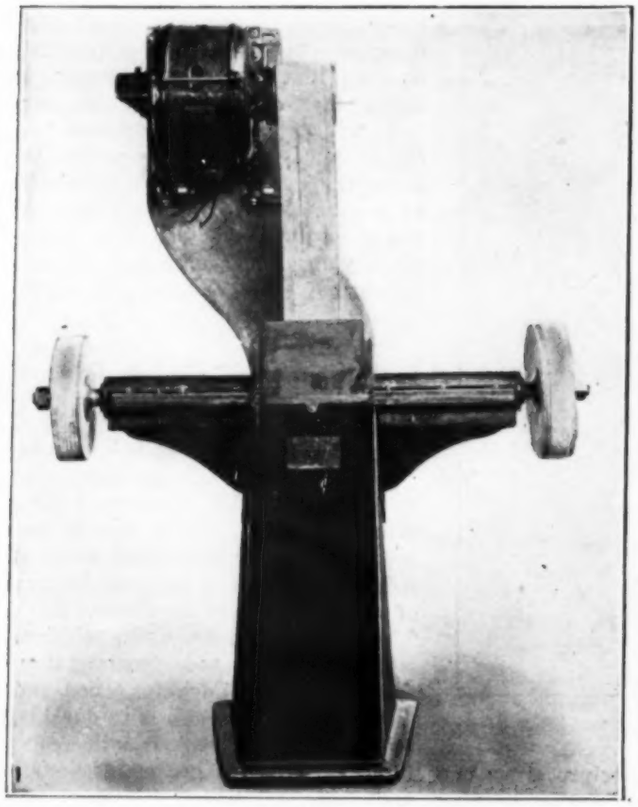
A roller bearing loose pulley manufactured by the St. Louis Machine Tool Co., St. Louis, Mo., and recently placed on the market, is shown in part section in the accompanying illustration.

This pulley is equipped with a pair



ST. LOUIS ROLLER BEARING LOOSE PULLEY

of adjustable taper roller bearings and is sold in any size from 2½ to 22 in. in diameter. For the small size the bearings are mounted directly on the shaft, and for the other sizes on a sleeve. The pulley has an oil hole and felt washers for proper lubrication of the bearing surfaces.



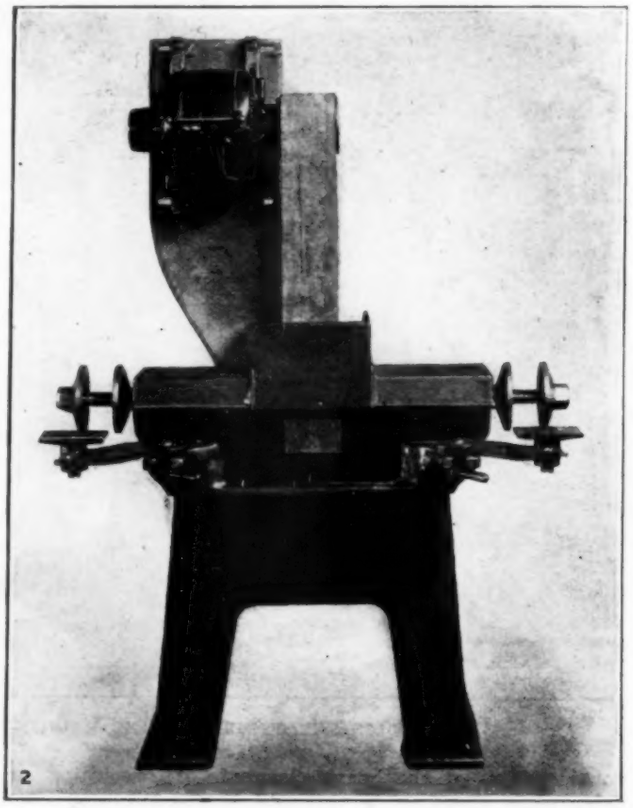


FIG. 1—ST. LOUIS MOTOR-DRIVEN ROLLER-BEARING POLISHING MACHINE NO. 7. FIG. 2—ST. LOUIS MOTOR-DRIVEN ROLLER BEARING GRINDER NO. 7

Louden Push and Pull Traveling Crane

An addition to the line of conveying machinery made by the Louden Machinery Co., Fairfield, Iowa, consists of a push and pull traveling crane, built in two sizes with load capacities, respectively, of 1,000 pounds and 2,000 pounds.

The bridge of the crane carries the crane track, consisting of a section of special Louden T-rail from which the load is suspended on a standard Louden carrier, and this crane track may be connected with any number of overhead carrying tracks running from the craneway. For aligning the crane with the outside tracks, a strong latch is arranged to catch and hold the crane track in alignment with the outside tracks while the load is being transferred from the crane to another crane or track. The crane remains locked in alignment until a chain is pulled to release the latch. When the ends of the tracks are disengaged a safety guard is automatically lowered so that loads cannot run off the open ends of the tracks. In the design of the crane an effort has evidently been made to keep the weight down as much as possible, consistent with the rated load capacity, so that the fully loaded crane may be handled by one man, who simply pushes or pulls the load in the desired direction.

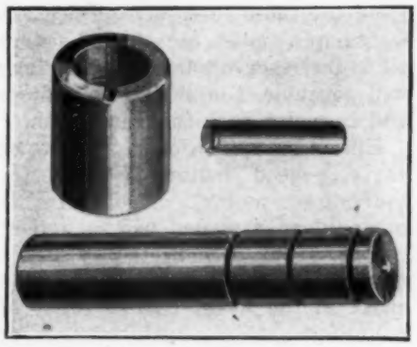
The bridge of the crane consists of two channels back to back, between which the crane track hangers are bolted. The ends of the channels rest upon malleable iron two-wheeled trucks and are securely bolted. Each truck wheel shaft runs in two Hyatt roller bearings which are mounted in dust-proof housings and fitted with grease cups. A squaring shaft, to which one wheel on each truck is fastened with setscrews, runs the length of the crane.

The 1,000 pound crane is built in spans up to 20 ft. and the 2,000 pound crane in spans up to 30 ft. It is claimed that the crane cannot be accidently thrown off the rails because it is so constructed that the ends cannot drop more than ½ in. without catching on the rails.

Danly Standard Pins and Bushings

In the manufacture of standard die sets, a line of standard leader pins, dowel pins and bushings, has been developed by Danly Machine Specialties, Inc., 4,911 Lincoln Ave., Chicago, Ill., and has recently been placed on the market.

The standard leader pins are made



DANLY STANDARD PINS AND BUSHINGS

of steel, carbonized, hardened and ground on centers to a tolerance of ±0.0002 in. from listed diameters. They are available in diameters from ½ in. to 1½ in. and in a variety of lengths from 4 in. to 9 in. Press fit allowances are made at one end.

Standard bushings are made in straight, shoulder and extra long styles. The inside diameters vary from ½ in. to 1½ in., and the corresponding outside diameters from ⅝ to 2 in. They are furnished in lengths from 1½ in. to 3½ in. An allowance of 0.0002 in. on the inside diameter is made for lapping and the press fit allowance on the outside is 0.002 inches.

The dowel pins are made of drill rod, hardened, drawn and ground. It is claimed that they can be driven in or out of holes without upsetting or bulging. Standard dowels are ground to within ±0.0001 in. of listed diameters, and 0.001-in. oversize pins are also carried in stock. Both standard and oversize pins are furnished in fifteen sizes from $\frac{7}{16}$x$\frac{7}{8}$ in. to ½x2¾ inches.

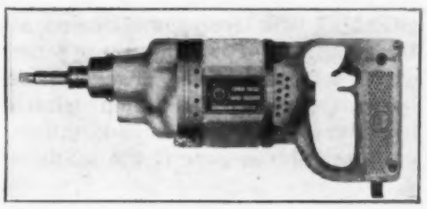
Black & Decker Light-Weight Electric Screwdriver

A recent addition to the large line of electric tools manufactured by the Black & Decker Manufacturing Co., Baltimore, Md., is a light-weight electric screwdriver, weighing 7 lb. and equipped with pistol grip and trigger switch.

The spindle, driven by a motor adapted for either direct or alternating current, carries a socket into which the screwdriver bits are inserted and held by a spring-pressed ball in a groove. No tools are required for changing bits.

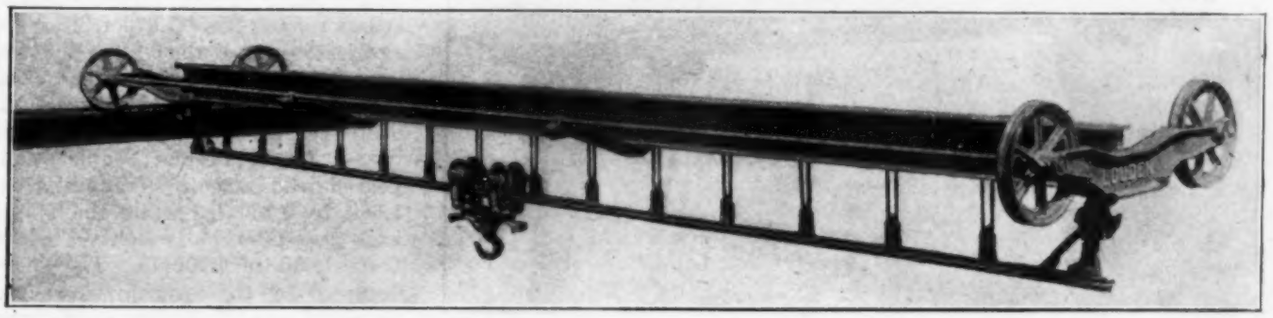
A clutch is provided so that the spindle is stationary except when pressure is applied against the screw by the operator. It is unnecessary, therefore, to start and stop the motor for each screw.

Socket wrenches can also be sup-



BLACK & DECKER LIGHT-WEIGHT ELECTRIC SCREWDRIVER

plied for the same tool thereby making it useful for running up studs or nuts. The no-load speed of the screwdriver is 350 revolutions per minute. With a proper lead hole, it is claimed that this tool is capable of driving a No. 14 wood screw 2½ in. long into hard wood, without stalling.



LOUDEN PUSH AND PULL TRAVELING CRANE

"American" Toolroom Lathes

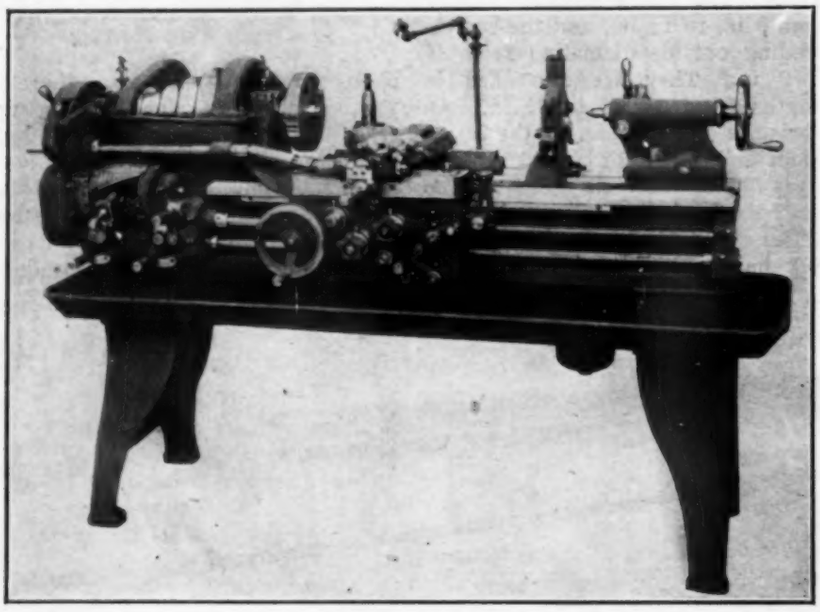
The toolroom lathe shown in the accompanying illustration is a machine that has recently been placed on the market by the American Tool Works Co., Cincinnati, Ohio. This machine can be furnished with either of three types of headstocks; namely, single back-geared head, double back-geared head or automatically oiled all-geared head. The type of head illustrated is used on all lathes up to 20 in. in size and provides eight spindle speeds, four direct speeds being afforded by the 4-step cone pulley.

A 3-step cone double-back-geared head of the quick-change, friction type is used on the larger sizes. Both the first and the second back-gear speeds on this head are secured by means of a frictional connection between the back-gear shaft and the gears. With this friction type of head it is claimed that changes can be made instantaneously from one back-gear range to the other without stopping the lathe, and that convenient control of starting and stopping is had by means of the speed control lever at the front.

The automatically oiled all-geared head provides twelve spindle speeds in geometric progression. This head is under instant control through either of two levers, one located at the right side of the apron, the other at the left side of the head. These levers operate a friction clutch incorporated in the driving pulley, or in the driven gear if the machine is motor driven. An external band brake operates in unison with the friction clutch, being engaged when the friction is released. This head may be used with a variable-speed motor drive by removing one gear unit and its operating lever and thereby producing four mechanical speed changes instead of twelve.

By means of a geared pump located inside the head, oil is pumped from a reservoir in the bottom of the head to a filtering and distributing tank in the head cover. After filtering, the oil gravitates to the various head bearings through oil pipes leading from the filter reservoir. Since the oil pump supplies considerably more oil to the reservoir than the bearings will consume, the surplus overflows and cascades over the gear teeth.

Either an a.c. or d.c. constant- or variable-speed motor is used for individual motor drive. It is mounted on a planed pad on top of the head and is connected by means of three helical gears to the initial shaft in the head. Other types of motor mountings, such as belt or silent chain connection between motor and driving shaft, or a motor mounted on the rear of the cabinet leg and belted to the driving pulley, may be supplied. Electrical apron control, which provides start, stop and reverse, is part of the regular equipment on motor-driven lathes. Mechanical control, with start, stop and brake, is provided for other types of drive, in the regulation manner.



"AMERICAN" CONE-HEAD TOOLROOM LATHE

A "drop V" type of bed is used which gives an additional turning capacity over the nominal swing. The apron is of the double-plate, box construction, giving all studs double support. It has steel gears and a removable rack pinion. Except on the 12-in and 14-in. lathes, the tailstock is provided with four clamping bolts for binding it securely to the bed, the two rear bolts being carried to the top of the barrel for convenience in clamping. The compound swivel is rectangular in form, and on all sizes above 16 in. it is equipped with four bolts for clamping into position. Full length taper gibs are employed on both the top and bottom slides of the compound rest.

The lathes are furnished in all sizes with the lead screw and feed rod independent of each other. The lead screw is preserved exclusively for threading, while the feed rod is used for all other feeding operations. On these machines no speeding up nor compounding is required to secure the coarse leads and feeds, the power transmission to the carriage on heavy work being direct through the cone and tumbler mechanism. An auxiliary quadrant in connection with the quick-change mechanism permits the application of change gears for cutting special threads not provided in the regular thread range. All bearings have renewable bronze bushings that are constructed to form annular oil containers, and feed the oil to the bearing by means of a felt strip inserted in a slot cut in the bushing.

Equipment which may be furnished includes taper, draw-in, universal and plain relieving attachments, collets, special coarse and fine thread ranges and metric screws.

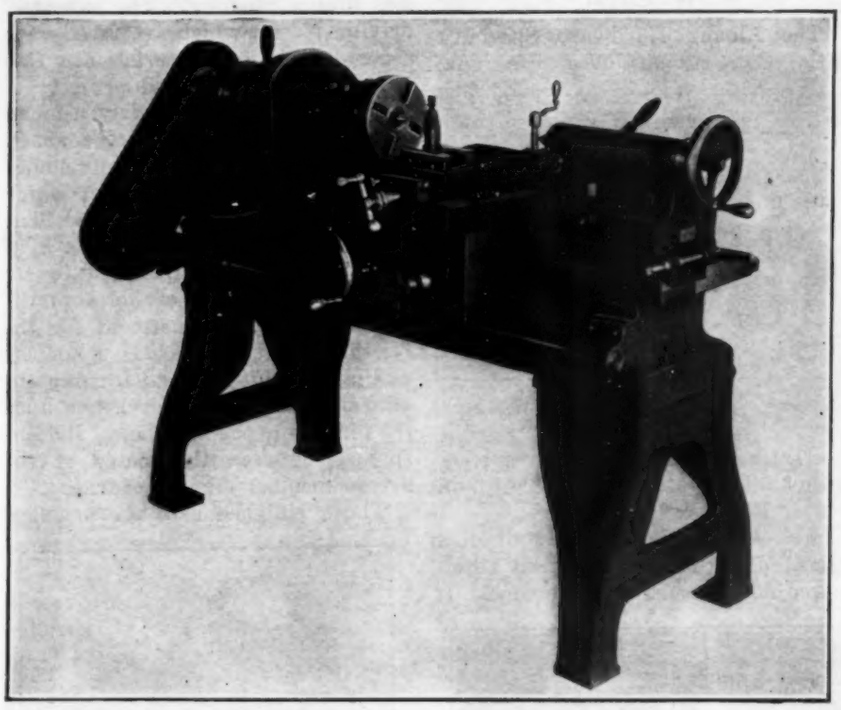
The machines are built in eight sizes ranging from 12 to 27 in. inclusive. The actual swing over the bed ranges from 14½ to 30½ in. and the base length of bed from 5 to 10 ft. The boxed weight without attachments of the all-geared-head lathes ranges from 1,870 lb. for the smallest size to 10,050 lb. for the largest, and the space occupied by the same lathes when boxed ranges from 52 to 191 cu. ft., respectively. The boxed weight of the double back-geared-head machines ranges from 1,680 to 9,100 lb. while the single back-geared-head weights range from 1,650 to 4,000 lb. The space occupied by these machines ranges from 50 to 189 cu. ft. and from 50 to 79 cu. ft., respectively.

Lynd-Farquhar Taper Turning Lathe

The Lynd-Farquhar Co., 419 Atlantic Ave., Boston, Mass., has recently placed on the market a lathe that is expressly designed for turning tapers.

The main feature of the lathe is an upper or auxiliary bed, capable of swiveling about a point midway of its length, and upon which the ways for the headstock and tailstock are machined. The ways upon which the carriage traverses are integral with the main bed.

The tailstock is provided with the usual wrench-operated clamping bolt which not only locks it against endwise movement upon the swivelling bed, but also clamps the latter to the main bed. Two eccentric clamps, operated with the same wrench, have a like function with respect to the headstock.



LYND-FARQUHAR TAPER TURNING LATHE

To turn any taper within the range of the lathe, the clamps of both head and tail stock are loosened and the upper bed is swung out of parallel with the main bed. The amount of departure from parallelism is indicated by the position of a witness mark in relation to a graduated sector at the end of the bed. The upper bed may be swung in either direction, the range being sufficient to turn any commercial taper.

At whatever angle the upper bed is swung, the live and dead centers remain in line with reference to each other, and the work thus retains a full and true bearing upon the centers. The line of centers is not, however, parallel to the line of traverse of the carriage, and the resultant work is, therefore, tapered to an included angle equal to twice the amount of departure as indicated upon the graduated sector. With the witness mark at the zero line of the sector, the lathe will do straight turning.

As the lathe is designed to do only plain turning upon comparatively small diameters, it has neither lead screw, change gears nor back gears. It is driven by a 3 in. belt to the three-step cone of the headstock and has but three spindle speeds, unless a multiple speed countershaft is used. A splined feed shaft along the front of the bed traverses the carriage through the usual mechanism. A clutch and knockout rod, with adjustable dogs, stops the feed automatically at any predetermined point.

Because of the sidewise movement of the headstock when setting the lathe to turn tapers, gears cannot be used to transmit power to the feed shaft, and a silent chain is therefore used instead. Five sprockets are furnished, and with such diameters that, by combining them in different ways, nine changes of feed are obtainable. Sprockets of other diameters for additional changes of feed can be furnished if desired.

The feed chain drives a gear that revolves upon a stud at the end of a short arm, the arm being pivoted upon the axis of the feed shaft. Angular adjustment of this arm compensates for varying sprocket center distances caused by the sidewise movement of the head, and maintains proper tension upon the driving chain.

The apron of the carriage is double and supports the gear studs at both ends. All studs are hardened and ground and are bronze bushed. The feed worm and wheel are enclosed and run in oil. Felt wipers at the ends of the carriage wings keep the ways free from dust and chips. The cross-slide is of the "rise and fall" type with wide and heavy bearing surfaces. The elevating screw passes through a ball nut, which allows the screw to adjust itself to varying angles, and is enclosed by dust caps and felt washers to exclude dirt. The barrel of the tailstock overhangs, so that the extra width of the carriage does not prevent the cutting tool from being brought close to the tail center.

The spindle is of steel, hardened and ground, and runs in composition bearings. A large thrust bearing sustains the endwise pressure of the cut. The cone pulley runs upon independent ball bearings and is locked to the spindle by a friction clutch which is operated by a conveniently placed lever. With the cone running continuously, the spindle may be stopped and started by means of this clutch lever which, in reverse position, operates a brake for stopping the spindle quickly.

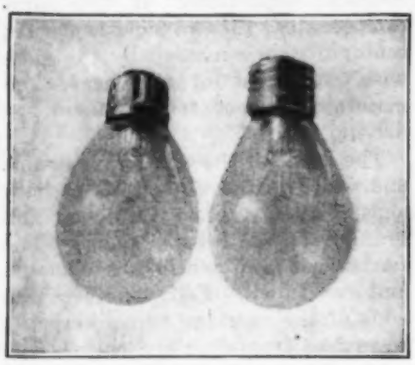
The lathe swings 16 in. over the ways and 5½ in. over the carriage. A distance of 16 in. is available between centers in the extreme position of the tailstock. It occupies a floor space of 6½x2½ ft. and weighs 2,000 pounds.

Kulp "Theft-Proof" Electric Lamp Bulb

An electric lamp bulb that is so constructed that it is practically impossible to remove it from a socket into which it has been screwed, has recently been placed on the market by Lester Kulp, 7732 N. Marshfield Ave., Chicago, Ill.

The bulb is made with a porcelain base, over which is slipped the brass

sleeve that is threaded to screw into the lamp socket. Assembling this sleeve to the bulb is the last operation in the process of manufacture, and just before the sleeve is put on, a few drops of hot solder are dropped into a vertical groove in the base. When the solder cools, it adheres to the



"THEFT-PROOF" ELECTRIC LAMP BULB

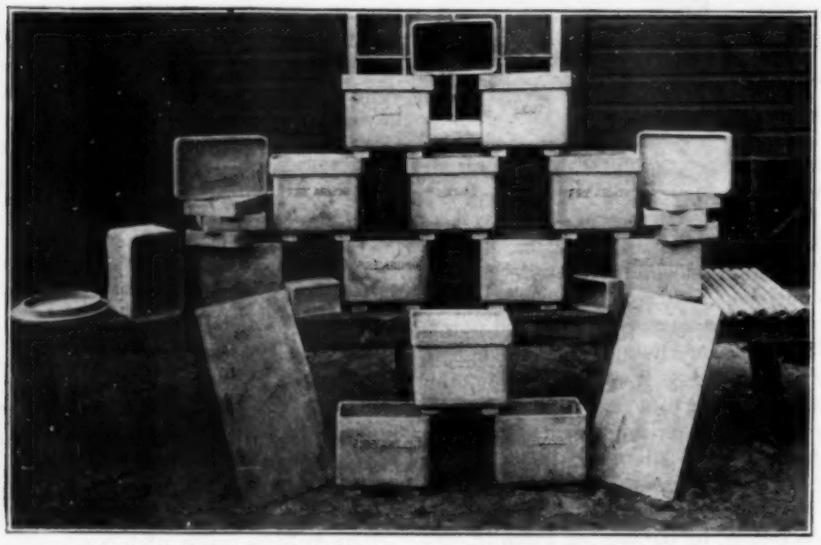
sleeve and holds it solidly on the base. When the lamp is put into service, it is screwed into a socket until the sleeve is in the full depth of the socket, then the lamp is given an extra turn which shears the solder. The bulb can now be turned either way without breaking the contact, but cannot be unscrewed from the socket while it is uninjured. If a lamp becomes damaged so that it is unfit for service, it can be removed by breaking the bulb and inserting the finger into the sleeve.

Chrobaltic "Five-Armor" Heat-Treating Containers

The containers illustrated herewith are for the purpose of holding tools made of high-speed steel during heat-treatment, and have been recently placed upon the market by the Chrobaltic Tool Co., 509 Railway Exchange Building, Chicago, Ill.

Since the heat-treatment of high-speed steel requires a temperature of from 2,200 to 2,210 deg. F., ordinary containers used for this purpose are comparatively short lived. It is claimed for the "Five-Armor" containers that they can be subjected to 2,350 deg. F. without injury.

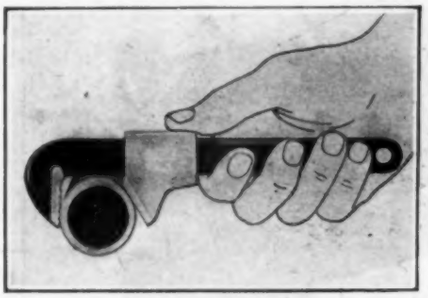
Tools to be heat-treated should be placed in a container and packed in charcoal. The cover is then put on. The box and contents are first preheated and then raised to the temperature point in the critical range where the carbide transformation takes place.



CHROBALTIC "FIVE-ARMOR" HEAT-TREATING CONTAINERS

Albany "Red and Ready" Wrench

The Albany Hardware Specialty Mfg. Co., Albany, Wis., is now marketing a wrench of the quickly adjustable type, called the "Red and Ready Rench."



ALBANY "RED AND READY" WRENCH

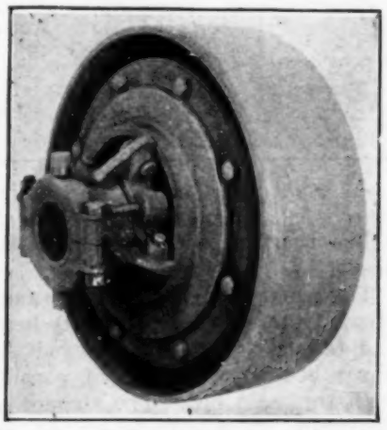
The tool is constructed of tool steel, drop forged, properly tempered and finished in red enamel. It is quickly adjustable for various sizes of nuts, bars or pipes, and can be used, it is said, to seize and turn pipes and bars which are located close to wall or floor. It is claimed that, by proper manipulation, the wrench will operate on a hex nut in a manner similar to a ratchet wrench. The 7-in. size has sufficient capacity for 1-in. pipe, 1$\frac{5}{16}$-in. round bar or $\frac{3}{4}$-in. hex nut.

Twin Disc Clutch Pulley

The Model B-14 Twin Disc Clutch manufactured by the Twin Disc Clutch Co., Racine, Wis., has recently been adapted for use on machine tools, and is now being marketed. The illustration shows the salient features of the device.

The belt pulley runs loose on the shaft and is provided with an oilless bronze bushing. The saw-steel driving plates, which are faced with asbestos friction material, are fastened to the pulley and project between the plates of the driven member, which is splined to the shaft. The outer end of the driven member is threaded for a ring upon which the releasing levers are pivoted. The ring is prevented from turning by a spring-pressed pin arranged to enter one of a series of holes in the movable plate. Adjustment for the friction surface wear is made by pulling out this pin and turning the releasing mechanism clockwise until the pin enters the next hole. Release springs between the plates of the driven member eliminate drag.

These clutches can be furnished



TWIN DISC CLUTCH PULLEY

in five sizes, ranging from 6$\frac{1}{2}$ to 14 in. in diameter and in capacity from 1.6 to 5 hp. Elimination of countershafts, decreased belt maintenance and ease of adjustment are among the advantages claimed.

News Section

Railroad Performance in First Half of Year

New high records for six months' traffic and efficiency were established by the railroads of the United States, as a whole, according to a report of the Car Service Division of the American Railway Association. The report emphasizes the fact that the railroads have achieved in the first six months of 1923 all the aims set forth in the program of the Association of Railway Executives on April 5 of this year.

The achievements of the railroads are outlined as follows:

"In the first six months of 1923 the railroads hauled the largest traffic ever hauled in any six months in their history.

"In June, 1923, they hauled the largest traffic ever carried in any one month.

"For the week ended June 30, they loaded 1,021,770 cars with revenue freight, exceeding the largest previous week's loading in history by 3,231 cars.

"In the first six months of this year 79,240 new freight cars were put in service and 1,998 new locomotives, leaving July 1, on order 96,855 freight cars and 1,902 locomotives.

"The total number of bad order freight cars has been reduced from 216,011, or 9.5 per cent in January, to 190,411, or 8.4 per cent in July.

"Bad order locomotives have been reduced from a total of 15,549, or 24.1 per cent on Jan. 1, to 11,450, or 18 per cent July 1. Locomotives in need of heavy repair have been reduced from 13,587, Jan. 1, to 10,326, or 16.2 per cent, in July.

"The number of repaired locomotives and cars turned out of the railroad shops per month has far exceeded the performance of previous years.

"The average daily movement of all freight cars has been increased from 27.9 miles in April to 28.6 miles in May.

"The reserve bituminous coal stocks have been increased from 6,756,886 tons, Jan. 1, to 10,667,371 tons in July of this year."

Increase Given Shopmen By N. Y. Central

The 30,000 shopmen employed on the New York Central R.R. were given an increase of 3 cents an hour by an agreement entered into by Vice-President J. G. Walborg for the road and a committee from Shop Craft Federation No. 103, headed by Bert M. Jewell, president of the railway department of the American Federation of Labor.

The increase is retroactive to July 1, and makes the rate for mechanics 73 cents an hour. Prior to the strike of 1922 the rate was 77 cents.

Indirectly the increase affects 25,000 men employed on the Michigan Central R.R. and other lines leased by the New York Central R.R. with which agreements are to be made, the subsidiaries usually following the lead of the operating company.

The agreement also provides for changes in shop rules which, pending action by the unions, were not announced last night. Unofficially it was stated that the matter of piece rates, in which the Central has insisted upon maintaining the system in such shops as it has been introduced, was left open.

Brig. Gen. Peirce Dies in Washington

Brig. Gen. William S. Peirce, assistant chief of the Ordnance department, died recently in Washington, D. C. Gen. Peirce was exceptionally well known among machine tool makers, especially those who dealt with the government during the war.

BRIG. GEN. WILLIAM S. PEIRCE

He was born in Burlington, Vt., in 1864 and after attending the University of Vermont for three years he was appointed to the United States Military Academy from which he was graduated in 1888 and assigned to the artillery. During his military career he was at the Watervliet Arsenal, the Springfield Armory, the Sandy Hook Proving Ground and the Rock Island Arsenal. For a short time he was stationed at the Midvale Steel & Ordnance Co. plant.

On Feb. 13, 1919, Gen. Peirce received the decoration of the Distinguished Service Medal for his exceptional work performed at the Springfield Armory of which he had charge. It was at the suggestion of Gen. Peirce that the American Society of Mechanical Engineers undertook the revision of certain of the War Department's specifications with the idea of making the Ordnance department's design conform more nearly to recognized commercial practices.

Railroads Good Buyers in Chicago

Dealers in the Chicago district report a rather slow movement of machine tools this week. Industrial buying is particularly dull. The Santa Fe and the Illinois Central R.R. closed on machine tool orders which were pending for some time and the Pere Marquette bought about fifteen machine tools for its shops. Jos. T. Ryerson & Son and Manning, Maxwell & Moore are said to have received the major part of these orders, and rumor has it that the latter was the principal seller to Battey & Kipp, the engineers who made rather extensive purchases for the Denver & Rio Grande. The Chicago, Burlington & Quincy Ry. has not yet placed orders on the large list which it issued some time ago.

Labor shortage in Chicago and Illinois has practically disappeared. According to the State Department of Labor, there are now approximately a hundred applicants for the same number of positions. The Chicago Branch of the National Metal Trades Association conducts an employment department which is an excellent barometer of employment conditions. That department reports an adequate supply of skilled workers including tool makers and general machinists. The metal trades plants are slowing up in operations, although June was the banner month in point of activity for Illinois industries since the improvement phase of the current business cycle began, according to the State's statistician. Production even showed a moderate tendency to expand over the previous high point reached in May which is a remarkable condition.

After several weeks of almost complete inactivity, sellers of pig iron noted with satisfaction the receipt of several inquiries from foundries for a few thousand tons of iron.

Holslag Wins Transformer Patent Suit

The decision of the examiners-in-chief of the patent office awarding priority of invention on an apparatus for and a method of arc welding with alternating current and relating particularly to a transformer having a special arrangement of primary and secondary coils and a so-called flux diverter, to Claude J. Holslag, has been confirmed by the Commissioner of Patents.

The original action was brought by Charles B. Walters who claimed to have been the inventor, but after an exhaustive examination of evidence it was decided that Mr. Holslag was the inventor and that the Electric Arc Cutting and Welding Co., Newark, N. J., owner of the patent, has the exclusive right to make and market. With this decision as the authority, the company states that prosecutions will be commenced against any users of tools having the infringed patent.

Indiana Expecting Busy Autumn

The market seems suddenly to have fallen below normal in the machinery business in Indianapolis. Reports from various of the larger dealers show business to be anything but satisfactory. Much of this is attributed to the season of the year. Many executives of the larger factories and purchasing agents are away on vacations and those, with whom the final decision rests seem to be missing when the dotted line is presented for signatures.

General industrial conditions also are having much to do with the situation. Those industries closely allied with the construction business seem to be the only ones to show any particular life. Dealers in brick-making machinery are having a better business than had been expected. The last year has seen more activity with brick manufacturers than any in history and the plants, which have been run continuously since shortly after the first of January are beginning to show wear and tear. Manufacturers and dealers in saw mill machinery say their business is holding up well and from indications will continue until late in the fall.

With the approach of the wheat harvest there is developing some activity among flour milling interests. Officials of the Nordyke & Marmon Co. here, manufacturer of this sort of machinery, say in view of wheat prices there is likely to be a lot of wheat held by the farmers for better bids, but this is having little effect on repairs and installations in the flour mills. Decreases in flour prices will mean more business for the mills which means more machinery. Road building machinery and special machinery for maintenance purposes is in big demand, branch house managers here say.

The tool business is not showing a satisfactory volume. Most of the large railroad shops here have cut their working forces to minimum, the divisions having terminals here having nearly completed their rehabilitation programs as planned early in the year.

Buying Continues in New York District

The Summer season of quietness is upon the Metropolitan district and dealers in all lines report that business is not as brisk as it has been during the other months of the year. This condition was not unexpected and most dealers are content with making a comparison with the same period last year when business was practically at the vanishing point. This July there are at least signs of improvement and a most hopeful future to look forward to. The Fall promises big business and indications are that the opening will be early.

Railroads are still buying for shops and fair sized orders are reported by several dealers who sell to the carriers. Machinery for repair work in automobile plants is also finding a market due to the let up in automotive production that gives the manufacturers a chance to overhaul their plants. There is not much encouraging news from the textile districts, but industrials seem to have gained ground and buying is reported from several centers.

The used tool field is not as active as it was, but as in the case of the new tool field those in the business state that the cause is merely the warm weather and not connected with economic conditions.

One dealer states that he will be much surprised if business does not resume its usual proportions by Aug. 15, while another dealer expresses the belief that September will be early enough for the renewed activity.

No Slump in Cincinnati Business

The machine tool houses in Cincinnati are keeping up about the same volume of business during July as they did in June. Some of the manufacturers say that orders have declined since last month while others state positively that their production is larger this month than last. Considering the fact that it is now mid-summer, orders coming in to the local plants and production of the various machine tool companies show that business is at least normal. In most cases it is better than it was at this time last year.

Although the Department of Labor at Washington recently made public a statement saying that there is an acute shortage of labor in the Cincinnati district, Cincinnati machine tool manufacturers find that the labor situation is better now than it has been for several months. The shortage has not been noticed to any great extent in the machine tool industry of this city.

Railroads are still actively in the Cincinnati market, although they are not buying as heavily as they were several weeks ago. The Chicago, Burlington & Quincy R.R. has purchased a large number of engine lathes here since the first of the year. The Atchison, Topeka & Santa Fe R.R. also has been a heavy buyer of lathes. The Pennsylvania, New York Central, Southern, Northwestern and Michigan Central railroads have been in the local market lately making purchases of machine tools.

Business is fair at present among those plants turning out conveying machinery. Many inquiries, however, are coming in which are expected to develop very soon into good business. Here the automotive and textile manufacturers are doing some active buying. The General Motor Co. and the Ford Motor Car Co. have been buying standard equipment. It is anticipated that the conveying machinery houses will have an increase in orders within a short time.

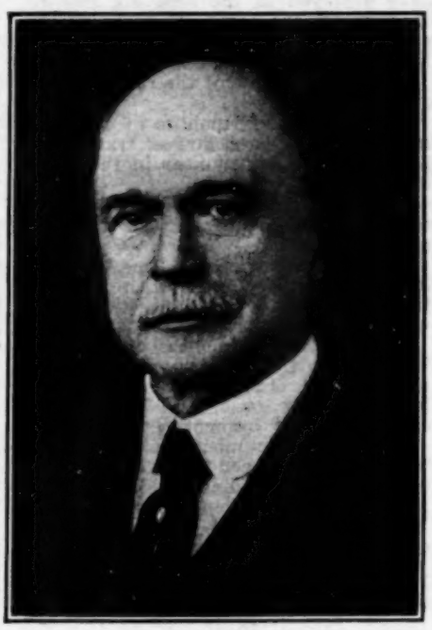
Machinery for the gas industry is being sold to some extent in the Cincinnati market. Business on machinery in the Pittsburgh territory is good for Cincinnati manufacturers. Westinghouse and the General Electric Co. have been doing constant buying in the Cincinnati market and have been big factors in keeping the volume of sales up to a high standard.

One of the Cincinnati machine tool houses states that it has exported a few radial drills recently to Japan. Other companies say that they have been doing a small export business which, however, does not mount to large figures. Railroads have been in the market for radial drills and some orders have come in from the Pacific Coast. Ball-bearing machines are being sold to automotive concerns in satisfactory numbers.

Robert W. Hunt Suddenly Dies in Chicago

Robert Woolston Hunt, founder and president of the Robert W. Hunt Co., of Chicago, died at his home in that city on July 11, at the age of 84 years. Funeral services were held in Chicago on July 13 and interment the following day at Troy, N. Y.

On Dec. 9, 1838, Mr. Hunt was born in Fallsington, Buck Co., Pa. He spent several years learning the practical side of iron making in the rolling mills of John Burnish & Co., Pottsville, Pa., and later took a course in analytical chemistry in the laboratory of Booth, Garrett & Blair. Upon the completion of this he entered the employ of the Cambria Iron Co. of Johnstown, Pa., and for them, on Aug. 1, 1860, established the



ROBERT WOOLSTON HUNT

first laboratory in America as a direct part of an iron or steel organization.

In the fall of 1861 he entered the U. S. military service and was in command of Camp Curtin at Harrisburg, Pa., with the rank of captain. Upon being mustered out of service he returned to the employ of the Cambria Iron Co. and was sent by it to the works at Wyandotte, Mich., where experiments with the new Bessemer process of making steel were being conducted. He was placed in charge of the experimental works in July, 1865, and so continued until May, 1866, when the Cambria company called him back to Johnstown to take charge of its steel business. It was at this mill later, and largely under Mr. Hunt's direction, that the first commercial order for steel rails ever made in America was rolled.

Later he assisted in designing and building the Bessemer works of the Cambria plant and in 1873, moved to Troy, N. Y., to become superintendent of the Bessemer works of John A. Griswold & Co., and in 1875 he became general superintendent of the Albany & Rensselaer Iron & Steel Co. During those years of active connection with steel rail manufacture he almost completely rebuilt the various works of this company and he also patented many

details of iron and steel metallurgical processes and machinery, including in conjunction with others, the first automatic rail mill tables.

Upon leaving Troy in 1888 he removed to Chicago and established the bureau of inspection, tests and consultation now known as the Robert W. Hunt Co.

Mr. Hunt was twice president of the American Institute of Mining and Metallurgical Engineers, past-president of the American Society of Mechanical Engineers, past-president of the American Society for Testing Materials, and past-president of the Western Society of Engineers. He was also a member of various other technical societies both in this country and Europe. Just one day before his death, the board of directors of the American Society of Civil Engineers had made Mr. Hunt an honorary member.

In 1912 Mr. Hunt was awarded the John Fritz medal for his contributions to the early development of the Bessemer process and in June of this year he was given the Washington award of the Western Society of Engineers in recognition of his achievements. He was for many years a trustee of the Rensselaer Polytechnic Institute and in 1916 received from it the honorary degree of Doctor of Engineering.

Mr. Hunt was a member of a large number of clubs, including the Chicago, Mid-day, Saddle and Cycle, and the South Shore, Glen View and Chicago Golf clubs. He was married in 1866 to Miss Eleanor Clark, of Ecorse, Mich., who survives him.

Personals

A. S. MOODY, assistant Northwest manager of the General Electric Co., has been appointed local manager of the Los Angeles office of the same company, to succeed R. L. CASH, who has been transferred to Schenectady. Mr. Moody is well known in the electrical industry on the Pacific Coast, having been identified with the General Electric Co. in that section for the past 16 years.

WILLIAM WHIGHAM, vice-president of the Carnegie Steel Co., Pittsburgh, Pa., has been elected a member of the executive committee of the citizens' committee on the city plan of Pittsburgh. During the past year he served as chairman of the citizens' committee on waterways.

P. F. FREEMAN, formerly engineer of tests with the Pittsburgh Testing Laboratory, has opened offices as a general consulting engineer in Pittsburgh.

H. A. SCHAUPP, of Johnstown, Pa., has been appointed secretary to W. W. Welsh, superintendent of the open hearth department of the LaBelle works of the Wheeling Steel Corp., Wheeling, W. Va., and has entered upon his duties.

FRANK N. SPELLER, metallurgist of the National Tube Co., Pittsburgh, Pa., has had the degree of doctor of science conferred upon him by the University of Toronto, Ont.

L. F. CARLETON has become Western representative of the Martin Marking Machine Co., of Turner's Falls, Mass. His headquarters will be in Chicago.

NORMAN BENSON, of Benson Bros., Australia, is visiting manufacturers in this country.

PROF. ROBERT H. SMITH, head of the mechanical laboratory at the Massachusetts Institute of Technology received the honoray degree of Master of Science at Rhode Island State College recently. Prof. Smith has been identified with M.I.T. for many years and is well known in the machine tool industry.

FRANK J. JARECKI has purchased the Manhattan Machine & Tool Works, Grand Rapids, Mich., and has changed the name of the concern to the Jarecki Machine & Tool Co. Mr. Jarecki was president and manager of the old company.

J. J. SIEFEN has left the Grand Rapids Brass Co. where he has been superintendent for the past two years and has become the manager of the Bennett Brass Co. which he has organized at a capitalization of $150,000. The Bennett company has purchased the assets of the Regle Brass Co. of Greenville, Mich.

CHARLES F. WOLCOTT formerly with the Pennsylvania R.R. has been appointed district manager of the car service division of the American Railway Association with headquarters at Pittsburgh.

JAMES E. AUTEN, for three years general purchasing agent for the LaFayette Motors Corp., Milwaukee, has been appointed works manager of the four-cylinder car division of the Nash Motors Co., in Milwaukee and assumed the duties July 15. B. W. TWYMAN, general manager of the division since its establishment four years ago, and GEORGE BECHTEL, for a similar period general superintendent, have resigned.

FRED H. DORNER, M. E., vice-president of the Milwaukee Engineering Society, and territorial sales representative of several large machinery manufacturers in Milwaukee and Wisconsin, has been elected the first president of the Professional Men's Club, International, just organized in Milwaukee. WALTER C. LINDEMANN, chief engineer and secretary, A. J. Lindemann & Hoverson Co., manufacturer of stoves, ranges and electric heating appliances, has been elected a director.

CHARLES W. MCKAY has been appointed manager of the division of valuation and appraisement of the Roberts-Pettijohn-Wood Corp., consulting engineers, Chicago. Mr. McKay was formerly president and general manager of McKay & Sherman and later of Charles W. McKay and Associates, valuation engineers.

Business Items

The new $500,000 foundry and shops of the National Cast Iron Pipe Co., at Birmingham, Ala., will be completed and ready for beginning operations about Aug. 15, officials of the company advise. The plant is equipped to make pipe under what is known as the De Levaud process.

The foundries and shops of the William J. Oliver Manufacturing Co., of Knoxville, Tenn., a company which went into the hands of a receiver some months ago, were purchased at auction this month for $100,000 by L. C. Gunter, of Knoxville, who has been acting as receiver since the failure of the company. Mr. Gunter's bid was the only one received, and he was acting for the bondholders. The plant, which is one of the largest of its kind in the South, has been estimated to be worth up to half a million dollars.

Fire of undetermined origin completely destroyed the building and all equipment of the foundry and shops of the Midway Foundry Co., of Burlington, N. C., July 10, causing a loss estimated at about $60,000, little of which was covered by insurance. It is understood that the plant will be rebuilt this summer.

The Shenango Furnace Co., Pittsburgh, Pa., operating a blast furnace at Sharpsville, Pa., is arranging for the rebuilding of the portion of the subsidiary works recently destroyed by fire, with loss estimated at about $35,000, including equipment.

The Cincinnati Enameling Co., of which Robert Heuck is president, will establish its business in one of the former plants of the Cisco Machine Tool Co., Elmore St. and the Baltimore & Ohio R.R., Cincinnati. The enameling company has secured a long lease with the privilege of purchase. Posesssion is given immediately and the new concern expects to start installing its equipment early next week.

A $60,000 structure is to be erected by the William Stacey Storage Co., Cincinnati. It will be of reinforced concrete and will be used for a warehouse and light manufacturing.

The William Powell Co., valve manufacturers, Cincinnati, will start work shortly on a $70,000 addition to its present plant.

Obituary

SAMUEL VANCAMP, vice-president of the VanCamp Hardware & Iron Co., Indianapolis, Ind., died July 5, in the New York City Hospital.

Mr. VanCamp, who was a son of Cortland VanCamp, founder of the VanCamp company, had not been active in the management for some time. He suffered a stroke of apoplexy six years ago and had been a semi-invalid since then. After spending the Winter at Miami, Fla., he, accompained by his wife and daughter, Lillian May VanCamp, sailed for France, in May, to obtain the services of a specialist in Paris. His condition became critical and the family returned to this country Sunday on the Aquitania. He was forty-five years old.

ROGER P. REDIER died recently in Paris. Mr. Redier was formerly European manager of the Allied Machinery Co. of America and had been manager of the Paris office of R. S. Stokvis & Son. He was well known to many machine tool makers in this country.

J. HARRY KITT, aged 57 years, died recently at Niagara Falls, N. Y. Mr. Kitt was for many years the traffic manager for the Carborundum Co. and was an authority on traffic matters.

News of Washington Activities

By Paul Wooton

THE storm center of the anthracite report of the United States Coal Commission is the recommendation that the President be authorized to declare a national emergency, in case of a deadlock between operators and mine workers and be empowered to take over the operation of mines and the distribution and marketing of the product. The operators fear that this would prove to be nationalization's entering wedge. Labor objects to it because there at least would be the coercion of public opinion brought to bear to make men work against their will. The public, however, seems to regard the measure with favor, not that it is anxious to see the Government undertake any business activity, but because it believes the industry will avoid any invoking of the emergency powers and with that alternative hanging over them will reach an agreement.

The recommendation of the Coal Commission in regard to emergency powers simply brings to the fore one of the big issues in our national life, it is pointed out. It has been recognized with increasing appreciation that some means must be found to break a deadlock between employer and employee when the continuance of that deadlock affects importantly the public welfare. The fact that the Coal Commission has made a concrete suggestion for the handling of such a situation insures the consideration of that and alternate plans at the forthcoming session of Congress.

The fact that the Commission has endorsed, in effect, a combination of big business interests, under suitable regulation, throws into the congressional arena another highly controverted problem of our industrial life. It has been very popular in Congress for many years to lambaste any large business enterprise on the assumption that being big is evidence of its predatory character. Opinion, even in Congress, is changing to the point where the efficiencies of big business and the various benefits to the public of combinations, are becoming apparent. It is true that the Coal Commission admits the possibilities of unjustifiable profits on the part of the anthracite combination, but on the whole its report shows that it was not afraid to commend it despite the fact that it is big.

New Light on Big Business

The other outstanding feature of the situation is the furor created by the published statement that the Attorney General influenced the report of the Commission. Members of the Coal Commission denounce the statement as being entirely false. No one acquainted with the Commission's membership would believe for a minute that they would brook any political interference with their findings. The difficulty is that there is a large number of persons within the coal industry more than anxious to believe the tale. In addition there is a portion of the public always willing to believe a story of sinister motive. It is admitted that the allegation has carried further than most untruthful statements. For that reason it will not be surprising if the Commission should take rather drastic and unusual methods to establish the malicious character of this charge.

The report reveals that the Commission believes the public is entitled to sit as an observer in the affairs of business. It is something like the position of the administration toward European affairs. Mr. Harding does not believe the Nation should accept any of the responsibilities of the reparations commission, but he has a very decided opinion that the United States is entitled to know what the Commission is doing. The Coal Commission is very determined in its belief that the Government should stay out of the coal business, but it believes it should know what is going on in that industry.

There are some engaged in the coal business who believe it would show the proper spirit were the industry to subscribe to some such sentiment as this: "We accept the main idea of the report that the public, through the Government, is entitled to know what we are doing. We are gratified to know that the public wants us to continue the conduct of this business. We think we can handle it better than anyone else. We agree with the Commission that we have a responsibility in providing uninterrupted service."

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0337	$0.034	$0.0276
Cold finished shafting	per lb	0.0428	0.042	0.0355
Brass rods	per lb	0.1825	0.1850	0.1650
Solder (½ and ½)	per lb	0.276	0.2862	0.21
Cotton waste	per lb	0.1231	0.1231	0.101
Washers, cast iron (⅛ in.)	per 100 lb.	4.66	4.66	3.83
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.08	3.08	3.11
Lard cutting oil	per gal	0.575	0.608	0.575
Machine oil	per gal	0.349	0.349	0.36
Belting, leather, medium	off list	37%	42½%	46⅔%
Machine bolts up to 1x30 in.	off list	44¼%	44¼%	53⅓%

Philadelphia Experiences Busy Summer

Manufacturers of high tension power equipment in Philadelphia had a larger volume of business in the first six months of this year than in the twelve months of 1922. There is a lively demand for substation equipment from the Northeast and middle Atlantic and Southern states, it was said by J. H. Dilks, general manager for the Electric Power Equipment Corp., producer of equipment from 7,500 to 220,000 volts.

This company has recently established an agency in South Africa, and orders for its equipment have come from there. There was some falling off in the orders last month compared to the month before.

Philadelphia manufacturers of textile machinery have had some orders sent to New Zealand, but the general foreign business has not been good. Production of textile equipment has not been as great in Philadelphia as production in some other lines.

Delivery to Philadelphia of upward of 10,000 tons of steel for the towers for the new Delaware River Bridge to Camden, N. J., was begun recently. Construction of the towers on the steel piers sunk to bedrock in the river will begin shortly. The delivery was from the Steelton plant of the Bethlehem Co.

While there was some dullness in a number of industrial lines, due to the midsummer season, many manufacturers express the belief that business generally is settling on a substantial basis. With this in mind many of them are preparing for an active Fall business.

It is the generally expressed opinion that underlying conditions in the steel industry are good. Many of the plants have orders from the railroads. The building program is progressing satisfactorily, with demands for equipment and materials used in all lines of construction.

Work at the plant of J. G. Brill & Co., car builders, and at the Baldwin Locomotive Works is proceeding at full capacity. Textile manufacturers are working full time, and generally throughout the industrial centers the situation is proclaimed to be satisfactory.

Jones & Laughlin Plan New Mill

The Jones & Laughlin Steel Corp. has tentative plans under way for the building of a new mill at Hammond, Ind., it is understood, where a site totaling 440 acres has been located. The new plant will include rolling mills, machine shop, power house, bar mill and other structures, estimated to cost close to $5,000,000, with equipment.

Cost of Living Shows Slight Decrease

The cost of living in the United States on June 15, 1923 was 60.1 per cent higher than in July, 1914, according to figures collected monthly by the National Industrial Conference Board. Between May 15 and June 15, 1923, there was a decrease of two-tenths of one point or one-tenth of one per cent. The only changes in the budget within the month were a decline in the cost of clothing and an increase in food prices. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and June, 1923, the cost of living dropped 44.4 points or 21.7 per cent.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THE election of a so-called radical to the Senate from Minnesota and a further slight decline in wheat were the outstanding events of last week. They are really correlated for it has long been realized that the price of wheat is a political factor in the United States.

But neither the discontent of the farmers as expressed at the Minnesota polls nor the probability that the Republicans will lose control of the Senate have had much effect on the markets.

The fact that wheat has sold at less than $1.00 a bushel in Chicago, which means not more than 75 cents to the average farmer, may somewhat reduce the purchasing power of the Middle West. But when we come to examine the record current quotations do not seem to justify the gloom they have generated in some quarters.

In September, 1922, wheat sold at under a dollar in Chicago, but we had prosperity nevertheless, and with everyone being urged to buy a barrel of flour and eat an extra slice of bread it is quite possible that because they have been so widely advertised the low prices of last week may prove to be the lowest of this season.

There is much in the history of the commodity markets to encourage this hope. When everyone was besought to buy a bale of cotton in 1914 the market for that staple commenced to improve and it generally happens that corn starts up when it is announced that the farmers are burning it.

The bales bought or the corn burnt did not make any appreciable difference in the supply, but they advertised the comparative cheapness of cotton and corn so effectively that many were induced to buy large quantities in the hope of profit. The psychological conditions of the market were therefore reversed and the decline was arrested.

These precedents lead me to doubt the likelihood of any further decline of importance in wheat, for the expected rarely happens in the speculative markets. It is, moreover, quite possible that the clamor that has been raised about the lack of an export demand for our grain may compel the administration to take a more aggressive interest in the economic reconstruction of Europe, in which case we should probably have a market for more grain than we would care to sell.

At all events the Stock Exchange was not much disturbed by the sinister interpretation put upon the week's news by the press and some prophets who have recently embraced the philosophy of pessimism. The market has been dull and most stocks have moved slowly upward with the railroad shares in the lead. This is not surprising for unless there is some cataclysmic depression it is likely that 1923 will be the best year in the history of American railroading.

And since it seems impossible that with a record movement of goods business can be bad it is logical to expect that the industrial and commercial profits of the year will also be large.

This conclusion is supported by the reports of the savings banks and life insurance companies published during the week. For the fiscal year ended June 30, 1923, savings bank deposits were increased by $680,000,000 and the new business written by the forty leading life insurance companies during the first six months of this year aggregated $3,922,000,000, which is an increase of 24 per cent upon last year's record.

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Surely there cannot be anything seriously wrong with a nation whose people are as prosperous and as thrifty as these figures indicate.

And while it suggests extravagance rather than thrift, another indication of our prosperity is to be found in the announcement that 13,200,000 golf balls will be "consumed" in the United States this year. But the protectionists will be grieved to learn that of this number over 3,000,000 will have been imported.

Another announcement that is more important in its cheerful significance is that an aggregate of over a billion dollars has already been loaned to the farmers by the twelve Federal Farm Loan Banks and the seventy-six Joint Stock Farm Land Banks thus far established.

As not more than 6 per cent can be charged on these loans the average saving as compared with the rates previously paid is probably 1½ per cent per annum. On a billion dollars this means a total of $15,000,000 a year, which will help to alleviate the pain caused by the decline in wheat.

This recital of some of our economic blessings and advantages is printed because there is a disposition in some parts of the country to insist that hard times must follow what is described as the triumph of discontent and radicalism that was evidenced at the Minnesota election.

To this view those who are familiar with economic history of the country will find it difficult to assent. Radicals there always have been and will be, but as land owners, as investors in stocks and bonds, as depositors in savings banks and policy holders in the life insurance companies, the majority of the American people are capitalists and it is idle to expect, as well as foolish to predict, that they will tolerate any serious effort to disturb the capitalistic regime.

Upon this hypothesis it may be safely assumed that present conditions, which are eminently sound, will find their logical reflection in activity at fair profits during the coming Autumn and Winter.

Merchants' stocks everywhere are small. Crops everywhere are reasonably good. Credit is everywhere abundant at fair rates and everyone who is willing to work at fair wages is employed.

This is a combination that is unbeatable and while it exists the talk of hard times in which some are indulging is nonsense or worse. It is inspired chiefly by those who are in a perilous position as a result of their misadventures on the short side of the speculative markets and it leads one to wonder whether such operations should any longer be permitted.

The commodity markets as a whole have been quiet and featureless. They call for but little comment and the foregoing generalizations are offered as better worthy of consideration than a detailed discussion of fluctuations that have been slight and meaningless.

The outlook in Europe is gradually improving. The Federal Reserve statement shows a gain of 1.1 per cent in the reserve ratio and there is every indication of normal activity when the crops are harvested and the vacation season is ended.

Florida Railway Buying Equipment

The Interstate Commerce Commission has authorized the Florida East Coast Railway Co. to assume liability for $2,000,000 of equipment trust certificates to apply on the purchase of the following equipment: Fifteen mountain-type locomotives at $59,200 each; five switching locomotives at $34,250 each; fifteen steel baggage cars at $23,000 each; two mail cars at $29,000 each; one dining car at $50.000; ten caboose cars at $4,286 each; 200 forty-ton steel flat cars at $1,785 each; 200 forty-ton ventilated box cars at $2,995 each.

Germany's Perplexing Finances

Selling machine tools a complicated problem for the German builders—How capitalization is accomplished with foreign backers—What the future holds

By OUR BERLIN CORRESPONDENT

A GLOOMY view prevailed at the annual meeting of the Society of German Machine Building Works with regard to the present situation of the industry as well as to the future prospects. The machine building industry has, it was declared, suffered greatly in the past year and the first half of the current year under the political and economical difficulties of Germany. While the eight-hour day and the legal obstacles against overtime work have been responsible to a large degree for the sluggish supply of raw material, the constantly shifting wages, the labor disputes, the depreciation of the mark rate, the lack of skilled workmen, the confusing taxation laws and the shrinkage of working capital have all increased the difficulties of production, it is claimed.

The constantly regrading ratio of efficiency is looked upon with alarm. According to the investigations made by the Society of German Machine Building Works, the average output per workman by the end of 1922 had dropped below one-half of the pre-war standard. While in 1913 the annual production per man was 7,700 kg., in 1922 it was only 3,900 kilograms.

The supply of raw material was and is constantly insufficient, especially with regard to bars and sheets. Considerable scope was given at the meeting to the question of payment in the case of exports. This problem has been solved by selling at foreign stable currencies. Over 80 per cent of the total machinery export is now being contracted in that way. The remainder —mostly for countries with depreciated currencies—is being treated in the same way as domestic sales. As such countries are frequently transshipping goods bought at the domestic German rates to other countries, several groups of industry have already closed the ring and make no more exceptions in favor of countries with weak currencies.

Selling Methods

The machine building industry has not followed this step so far, although a strong inclination exists in some sections. Selling at firm prices has been abandoned altogether, except for machinery from stock or at short delivery. Orders for the future are being accepted at sliding prices only, whereby as a rule one-third of the purchase price is demanded to be paid with order, the second third between the dates of the order and the delivery. Sliding prices are fixed according to the price regulations issued by the various sections of the machine building industry for its members.

In the matter of advance payments two different lines of procedure are considered acceptable. According to one, the buyer has to agree to pay the second third of the purchase price at a fixed time at the rate of the price prevailing at that time, and in addition the difference between this payment and his first payment. At delivery he has to pay the rest of the purchase price at the rate prevailing at the time. The actual purchase price resulting from this mode of payment is at a constantly depreciating ratio to parity and, of course, much higher than its face value would indicate. By the other method only one advance is made before the delivery of the goods.

According to figures submitted at the meeting, the total production of the German machine building industry, comprising all lines of machinery with the exception of the electric and automotive industries, in 1922 was approximately three million tons, of which 500,000 tons or one-sixth was exported. It was mentioned with great satisfaction, that the import during the same time amounted to only 10,700 tons or about 2 per cent of the export and 0.03 per cent of the total production. In spite of this fact, it was declared that a stronger tariff protection of the German machine building industry would be absolutely required in the future.

Slight Business Improvement

With regard to the business situation, a steady decline of the market was observed all through the past year and continued at a greatly accelerated rate in the current year. The revival of business, expected from the downslide of the mark rate, was declared to be slow in coming, except in the machine tool industry, in which a considerable improvement is already noticeable. It is, however, accepted as a fact that the time when Germany could enjoy an individual boom of its own in the midst of universal business depression is over and that not until the reparations problem and the Ruhr war are ended could a return of brighter times be expected. The recent improvement of the business of the machine building industry can be seen from the labor statistics.

At the beginning of May, 72 per cent of the total number of workmen employed in the machine building industry were working full time, 21½ per cent at short time from 9 to 24 hours per week, and the rest were unemployed. The sharp drop of business, which has taken place in the course of the current year can be gaged when considering that unemployment at the corresponding time of last year amounted to only ½ per cent and in December to ¾ per cent. At the beginning of June the percentage of full time workers had increased to 80 per cent while that of short time workers dropped to 15 per cent. The percentage of unemployed was 5 per cent which largely exceeds that of any of the three preceding years. Since manufacturers are not allowed to dismiss workmen except for excellent reasons, this percentage does not represent the true state of affairs, but is only of value when taken relatively. Under conditions prevailing, the extent it has reached is of grave significance, especially when considering that the state bank has and is extending large credits to works insufficiently employed in the interest of keeping the men in bread and butter. A special organization has been formed for this purpose primarily in the interest of the works situated in the Rhineland and Westphalia, but later it may also extend to works in the German interior. The total of credit extended to the industry amounted at the end of May to over 5,000 million marks, of which the machine building industry has taken the lion's share.

As has been mentioned, a distinct line has been drawn with regard to credit between small and medium-sized firms on the one hand and the large concerns on the other. The latter are supposed to be able to help themselves. The opinions of their capacity to do so are diverging. The true financial situation of the large machine building companies is a closely guarded secret. The views entertained with regard to it even in authoritative circles vary from a picture of enormous wealth of gold capital down to one of financial distress. A few facts have lately taken place which permit a fair estimate. Investigations have shown that the gold capital of the whole German industry constituted by foreign funds accredited at German banks amounts to from 1,500 to 2,000 million gold marks. Of such funds the machine building industry owns perhaps one-fifth part. The amounts deposited in foreign banks have not been ascertained, but from the offer recently made by the industry of an annuity of 500 million gold marks towards reparations, it is quite clear that the gold basis of the German industry is considerably larger than the funds deposited with the inland banks would indicate.

Conserving Gold

It is now an admitted fact, boldly stated for instance in the last annual report of the Magdeburg Machine Tool Works, that the industry is in the habit of transferring every surplus of cash at once into stable currencies. It has become now quite a custom to calculate and pay dividends in gold. A survey of the balance sheets of industrial firms shows that none keep a cash balance of marks. They have only mark debts, which can be discharged advantageously at a depreciated rate. New capital issues do not give a true insight into the financial situation of the industry. In spite of the huge figures they reached in the current year, their total in goldmarks was considerably below pre-war capital requirements and much less than last year's. The ridiculously low rate at which new capital issues are floated creates the impression that such capital issues are not used or wanted for increasing working capital, but more for the reason of watering the stock or broadening the nominal capital basis.

As far as the general requirements of working capital are concerned, the development has gone in another direction, which is becoming more and more marked, the foreign money markets. It is a known fact that foreign capital

has in the course of time acquired a considerable interest in German industry by the purchase of stock on the stock exchange. This interest, in which the machine building industry has probably the larger share, is officially estimated at no less than 10 per cent, but may be considerably higher. Apart from such open transactions, others on a much larger scale are made under the surface. Large blocks of new capital issues are frequently sold to foreign capitalists or given as collateral for foreign credits. There can be no shadow of a doubt, that the German industry is on the road to the internationalization of its capital. How far this movement has progressed is not known, but occasional discretions make it quite clear that a considerable number of German machine building works are under a German name shielding foreign ownership or control.

How far actual need of capital has to do with this development is a matter of conjecture. That the latter case applies in a large measure to the capital transactions concerning a number of Rhenish machine building works, concluded since the Ruhr occupation, is an established fact. The impression, however, is received and well corroborated by facts coming to the surface, that the gloomy views expressed in the numerous complaints constantly heard of the machine building industry are largely exaggerated and that of all the parts of Germany's economical structure this industry has well been able to preserve its strength during past periods of storm and stress.

Long Island R. R. Plans Large Expenditure

The Long Island Railroad will expend $84,000,000 in the next ten years for improvements to uphold its reputation for carrying more daily commuters than any other American railroad, George Le Boutillier, vice-president, said recently. Mr. Le Boutillier was the principal speaker at a "get together" meeting of the Long Island Press Association, the Long Island Association and railway company officials at the Clifton Hotel in Patchogue.

Addressing several hundred guests, Mr. Le Boutillier said:

"I presume everybody is watching to see how many more millions the beneficent Pennsylvania R.R. will contribute toward carrying out this tentative program, but I'm afraid the Pennsylvania cow has already been milked dry, and the money will have to come from other sources. While I am handicapped in this respect, I have the utmost confidence that this money will be forthcoming, for the Long Island Railroad today is earning a profit, and its credit has been restored."

Canadian Railways Will Buy Equipment

The Canadian Government will raise $22,500,000 to be spent on new equipment for the Canadian National Railways through the sale of that amount of fifteen-year 5 per cent serial equipment bonds, it was announced recently in Toronto when the Minister of Finance of the Dominion Government issued a call for bids from Canadian dealers.

American Machine Tools In Russia

The following wireless from Moscow by Walter Duranty appeared recently in the New York *Times:*

"A test in American business possibilities in Russia will be given by a contract just signed between the Russian Foreign Trade Monopoly Department and the Allied American Corp., the pioneer American concern in the Russian field.

"The contract gives the Americans the full rights to conduct an import and export busines independently of the Monopoly Department for the trial period of one year, and provides that the amount of the yearly turnover must not be less than $2,400,000. It also prescribes that imports must not exceed exports in value, but both may go to any limit beyond the minimum named.

The Soviet's New Method

"An interesting feature of the contract, from the American point of view, is that the Monopoly Department no longer insists on half the shares being owned by Russians, as it has in the past for contracts of this kind. The American corporation agrees to pay 50 per cent of its profits to the Foreign Trade Monopoly Department, this undertaking being backed by a bank deposit as guarantee and a further guaranteed minimum.

"It is expected that the greater part of the import business will be in machinery and tools, for agriculture and industry. The allied American Corp. has made exclusive contracts with upward of thirty well-known American firms, including the Ford Motor Co., the United States Rubber Co., the American Tool Works and the United States Machinery Co., to act as their agent in Russia. The exports will be mostly raw products like furs, bristles, flax, timber, caviar and semi-precious stones, which the American corporation will be allowed to buy in the open market through the branches it proposes to establish throughout European Russia and Siberia.

The Importance of Russia's Gold-Secured Currency

"Doubt may arise in the minds of American leaders regarding the medium of payment, inasmuch as the depreciation of the Soviet ruble has become a byword. First, this very American company has done $1,500,000 worth of business here without a cent of bad debts; second, . . . Russia's financial comeback is based on chervonetz, which today, though paper, stands on a par with the dollar and the pound sterling, and this after eight months' experience. Throughout Russia chervonetz is gradually replacing the old paper currency. By the first of next year it is hoped it will be the only money in Russia, and will gradually be replaced by gold and silver currency already being minted to the extent of millions of dollars.

"The real importance of this contract to American business men is that it forms a precedent for the independent activity of Americans in Russia without interference or control on the part of the Soviet organizations."

Robert S. Alter, vice-president of the American Tool Works, has taken an active interest in furthering this work.

Trade Catalogs

Metal Treating Products. American Chemical Paint Co., Philadelphia. The products and processes of manufacturing by this company are briefly described in a booklet that has been issued. Rust problems arising in the construction of steel automobile bodies and parts and in other industries using similar operations are discussed.

Steel Castings. Electric Steel Co., Chicago. The thirty-three bulletins that have been issued by this company since Dec. 28, 1921 are bound together in a booklet that has just been published. Various methods, results and modes of operation are emphasized and illustrated.

Tool Room Lathes. The American Tool Works Co., Cincinnati, Ohio. An exceptionally well illustrated catalog devoted to the toolroom lathe has been issued by this company. Parts and sections are clearly described and the many advantages of the product are pointed out.

Sheet Metal Working Tools and Machinery. Niagara Machine & Tool Works, Buffalo, N. Y. Bulletins 63, 64 and 65 have been issued by this concern. Bulletin 63 describes the straight sided single crank power presses and trimming presses while bulletins 64 and 65 describe the double crank power presses made by this company. All three of the bulletins are well illustrated, contain tables and specifications and are clearly written.

Leather Belting. Chicago Belting Co., Chicago. A folder on leather belting showing the many advantages of good belting over others of inferior quality has recently been issued by this company.

Tool and Cutter Grinding Machines. The Norton Co., Worcester, Mass. A handbook containing some very valuable information on tool and cutter grinding. The book is well illustrated and bound and has chapters of instruction on various phases of grinding.

Tools. DeBats Metals Co. New York City. Tools cast from DeBats metal are described in a folder that has recently been issued by the company. Many features are claimed for the tool such as longer life, double speed, heavier chips with less power and its ability to cut either iron or steel.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

One 10-ton locomotive crane. Hongkong, China. Purchase. Reference No. 7171.

Dredges, either suction or bucket type. Pernambuco, Brazil. Purchase. Reference No. 7130.

Laundry machinery, sandpaper-making machinery and spinning machinery. Montevideo, Uruguay. Agency. Reference No. 7185.

Woodworking machinery. Magoya, Japan. Purchase. Reference No. 7183.

A woodworking machine for cutting, planing and grooving. Torreon, Mexico. Purchase. Reference No. 7103.

Forthcoming Meetings

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit Sept. 18, 19, 20 and 21. Mason Laboratory, New Haven, Conn. A. C. Jewett, chairman.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

American Management Association. October 29, 30, and 31 Hotel Astor, New York City.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Iron and Steel—Improvement shown in pig-iron inquiries. Lower iron prices for fourth quarter, checked by growing firmness of the coke market. Steel bars remain firm at $2.40 per 100 lb., despite lower pig-iron and scrap prices. Slightly better inquiries for structural shapes during last two weeks; firm at $2.50 base with few prospects of lowering. Slight falling off in new plate orders. Steel mill operations slowing down gradually.

Advances—Black and galvanized steel sheets, cold finished steel and aluminum ingots, higher in Chicago warehouses. Western lead, for July shipment, advanced slightly during week. Solder up 1c. per lb. in New York.

Declines—Copper weaker; down ⅛c. per lb. in New York. Slowing down in steel, exerting depressing effect upon tin market; quotations ¼c. under week ago. Zinc market lifeless; dropped 10c. per 100 lb. in week. Antimony lower in Cleveland and New York. Steel bars and plates down in Chicago; fabricated brass and copper, solder and babbitt metal, in Cleveland; linseed oil and babbitt metal, in New York.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.05
Northern Basic	29.27
Southern Ohio No. 2	29.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.25
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	28.76
Virginia No. 2	32.17
Basic	27.76
Grey Forge	27.26
CHICAGO	
No. 2 Foundry local	29.11
No. 2 Foundry, Southern (silicon 2.25@2.75)	30.51
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	27.77
Basic	26.77
Bessemer	28.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	6.75@7.40
Cincinnati	7.50
New York	5.50@7.00
Chicago	5.00@5.50

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.50	3.75	4.15
No. 12	3.10	4.64	3.80	4.20
No. 14	3.20	4.69	3.85	4.25
No. 16	3.40	4.79	3.95	4.35
Black				
Nos. 17 and 21.	3.70	4.95	4.45	5.05
Nos. 22 and 24.	3.75	5.00	4.50	5.05
Nos. 25 and 26.	3.80	5.05	4.55	5.10
No. 28	3.85	5.15	4.65	5.20

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	4.00	5.15	4.70	5.35
Nos. 12 and 14.	4.10	5.25	4.80	5.45
Nos. 17 and 21.	4.40	5.55	5.10	5.75
Nos. 22 and 24.	4.55	5.70	5.25	5.90
No. 26	4.70	5.85	5.50	6.05
No. 28	5.00	6.15	5.80	6.35

WROUGHT PIPE (Welded)—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	62	50½	⅜ to 1¼	30	13
LAP WELD					
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	60	49½	⅜ to 1½	30	14
2 and 3	61	50½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50	8.00	6.55
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.40	3.90	4.55
Cold finished flats, squares	4.90	4.40	5.05
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.25 at mill)	3.54	3.36	3.20
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8½c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			39.25
Lead (up to carlots), St. Louis	6.00	New York	6.57½
Zinc (up to carlots), St. Louis	6.15	New York	6.60

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	27.00	28.00
Antimony (Chinese), ton spot	7.85	9.50	8.25
Copper sheets, base	24.50	23.50	23.00
Copper wire (l.c.l.)	17.25	20.75	16.25
Copper bars (l.c.l.)	22.00	24.00	19.50
Copper tubing (l.c.l.)	27.00	29.00	23.00
Brass sheets (l.c.l.)	19.75	29.25	18.75
Brass tubing (l.c.l.)	25.50	29.25	20.50
Brass rods (l. c. l.)	18.00	29.00	15.75
Brass wire (l. c. l.)	20.25	23.75	.....
Zinc sheets (casks)	10.25	10.10	.....
Solder (½ and ½), (caselots)	29.50	27.75	20.00
Babbitt metal (83% tin)	52.00	48.00	40.00
Babbitt metal (35% tin)	25.00	17.00	16.00
Nickel (ingot and shot)	29.00	.....	35 00
Nickel (electrolytic)	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00
Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	12.50
Copper, heavy, and wire	11.50	11.50	11.50
Copper, light, and bottoms	10.00	9.50	10.50
Lead, heavy	5.00	5.00	5.00
Lead, tea	4.00	4.00	3.75
Brass, heavy, yellow	7.50	....	7.50
Brass, heavy, red	9.50	9.50	9.50
Brass, light	6.00	5.00	6.50
No. 1 yellow brass turnings	7.00	6.00	7.00
Zinc	3.75	3.00	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$19.50	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	12.60	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13¼x13¼, per lb.	10.75@11.00	36.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	1.08	1.22	1.28
White lead, dry or in oil	100 lb. kegs.	New York, 14.00	
Red lead, dry	100 lb. kegs.	New York, 14.00	
Red lead, in oil	100 lb. kegs.	New York, 15.50	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$4.75@5.25	
Coke, prompt foundry, Connellsville	per net ton	5.75@6.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65 5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅜ and smaller	60%	.....	...
Semi-finished nuts, ½ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, ⅞ in. dia. and smaller	40%	50-10%	60%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30-10%	30-10%	30-10%
Heavy grade	20-5-2½	30%	20-5-2½%
Rubber and duck:			
First grade	.50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

D. C., Wash.—Dist. Comrs.—receiving bids until Aug. 3 for one 12 in. x 5 ft. engine lathe; until Aug. 2 for one gasoline propelled portable crane with boom and clamshell.

Ill., Chicago—M. Vitek, 4017 South Kedzie Ave. (machine shop)—power drill press, lathe, cylinder grinder, emery stand, belting, hangers, pulleys and shafting.

Ill., Harvey—S. Ward Hamilton Co. (manufacturer of hardwood specialties)—drill presses, medium size punch presses, belting and shafting.

Kan., Winfield—C. H. Benson, 1215 South Main St. (garage)—power drill press, emery stand, power metal lathe, cylinder grinder (used preferred).

Kan., Winfield—Barr Motor Co., H. M. Barr, Purch. Agt.—power automobile cylinder grinder.

Kan., Winfield—G. F. Ganett, South Main St. (garage)—power drill press.

Kan., Winfield—F. W. Guild, 1190 Main St., (garage)—power metal lathe.

Kan., Winfield—L. Moore Implement Co. (garage and machine shop)—power drill press, metal lathe, emery stand, wheel and cylinder grinder (used preferred).

Kan., Winfield—Standard Auto Wrecking Co.—power metal lathe.

Kan., Winfield—Stewart & Wheeler, East 9th St. (fixtures and accessories)—power emery stand and wheel.

Kan., Winfield—Tingle Shop, 214 East 9th St., J. A. Tingle, Purch. Agt.—10 ft. tinners brake and power metal lathe for machine shop.

Ky., Middlesboro—Motch Motor Co.—lathe, air compressor and drill press for proposed $50,000 garage.

La., Shreveport—Bender Steel, Iron & Supply Co.—foundry and machine shop equipment, including lathe, press, drill, grinder, etc.

Md., Baltimore—Carey Mchy. & Supply Co., 119 East Lombardy St.—quadruple punch and shear.

Md., Baltimore—Flynn & Emrich, 305 North Holliday St.—complete machine shop equipment.

Mich., Detroit—Bd. Educ., 1354 Bway Ave., C. A. Gadd, Business Mgr.—eighteen 9 x 36 in. metal working lathes, complete with legs, gears, etc.; six 13 in. x 4 ft., single back geared, engine lathes; one 13 x 56 in. engine lathe; one sensitive floor drill; two 20 in. drill presses; one milling machine; one 14 or 16 in. back geared crank shaper; one grinder for 1½ x 1½ x 12 in.; two arbor presses, bench type, to take up to 12 in.; four 9 x 36 in. metal working lathes.

Mich., Marquette—E. G. Davett (automobile repairs)—medium size drill press, emery grinder, air compressor, gasoline storage tank and pump.

Mo., Kansas City — Marshall Mfg. Co., 912 Grand Ave.—two power punch presses.

Mo., Kansas City—Natl. Lead Battery Co., 1601 Oakland St.—one 25 ton punch press.

Mo., St. Louis—Williams Patent Crusher & Pulverizer Co., 813 Montgomery St. (manufacturer of crushers)—No. 5 Mitts & Merrill hub keyseater with or without motor (used).

N. J., Bloomfield—Bast Reflector Co., 122 Belmont Ave.—complete machine shop equipment.

N. Y., Centerfield—L. Parker—garage, repair shop and service station machinery, tools and equipment, including small bench tools, grinder, etc., to replace that which was destroyed by fire.

N. Y., Dansville—Macomber Garage Inc., Ossian St.—air compressor, press, drill, machine and bench tools, etc., for proposed $40,000 garage and service station.

N. Y., Salamanca—Bd. Educ., G. A. Price, Supt.—sheet metal working machinery and equipment, including shear, bender, etc., for vocational school.

N. Y., North Tonowanda—Buffalo Bolt Co., East Ave. and Oliver St.—equipment for manufacturing bolts, for proposed $20,000 addition.

O., Columbus—N. A. Newdick, 368 North 4th St.—machine shop equipment.

Okla., Ponca City — Marland Refining Co.—machinery, small tools, air compressors and pumps for several proposed gasoline and service stations in Kansas.

Ore., Portland—G. H. Kelly, Spaulding Bldg.—machine shop, also saw, planing mill and dry kiln equipment.

Pa., Danville—Pennsylvania Brake Beam Co.—one roll angle straightening machine, capacity ⅛ x 2½ x 2½ in.

Tex., Plainview—C. B. Thomas—8 ft. tinners brake.

Va., Richmond—Chenault Bicycle Co., 1829 West Main St.—drill press and air compressor.

Va., Richmond—Ford Auto Service Co., 110 East Jackson St.—lathe and portable electric drill.

Va., Richmond—W. D. Jones, 207-209 East Jackson St.—portable electric drill and lathe for automobile repairs.

Va., Richmond—New Bell Motor Co., 1624 West Main St.—grinding in machine, drill press and movable jack.

Va., Richmond—Seay & Askew, 1829 West Main St.—drill press and lathe for automobile repair shop.

Va., Richmond—Standard Electric Co., 1821 East Main St.—lathe and drill press.

Va., Richmond—Sycamore Ford Service Sta., 1 North Sycamore St.—drill press.

Va., Richmond—J. F. Vogel, 315 North 2nd St. (bicycle and gun repairing) small lathe for metal turning.

Va., Richmond—West End Garage, 2310 West Main St.—lathe and drill press.

Wis., Appleton—Northern Boiler & Structural Iron Co., Mill St.—plate shears.

Wis., Appleton—Seamless Tube Co. of Wisconsin, c/o M. Rossmeissel, 977 8th St. (manufacturer of boiler sheets and steel tubes)—plate shears, riveting hammers and rolls.

Wis., Milwaukee—Curtis Auto Co., 143 8th St.—repair equipment, hoists, air compressor, gasoline service tanks and pumps for proposed $200,000 garage on Bway.

Wis., Shawano—J. Popp—automobile repair machinery, chain hoist and tanks for proposed $40,000 garage.

Ont., Toronto — Tube Products, Ltd., Bathurst St., G. A. Macguire, Purch. Agt.—machinery, etc., for the manufacture of seamless wrought iron pipe.

Que., Beloeil Village—F. Boucher—repair equipment for garage.

Que., Chambly Canton—H. Desroches—automobile repair and garage equipment.

Que., Chateauguay—Chateauguay Motor Garage, E. Laframbois, Purch. Agt.—repair equipment.

Que., D'Israeli—I. F. Lapointe—complete automobile repair equipment.

Que., East Angus—J. B. Morin, Ltd.—garage and automobile repair shop equipment.

Que., Huntingdon — J. C. Boyd, Lorne Ave.—garage and automobile repair shop equipment.

Que., La Patrie—S. Gabell—garage and repair machinery.

Que., Louisville—D. Bourassa—garage and automobile repair equipment.

Que., Magog—Patch & Cotterall, Registered, Main St.—additional automobile repair equipment.

Que., Mahog—A. Renaud, Sherbrooke St.—additional equipment for garage and repair shop.

Que., Marbleton—F. A. Porter—automobile repair shop equipment.

Que., Montreal—Central Garage, Ltd., 260 Pine Ave., E.—garage and repair shop equipment.

Que., Montreal—J. Crowe & Sons, 17 St. George St., (blacksmith, machinist and locksmith)—additional machine shop and acetylene welding equipment.

Que., Montreal—E. David, 566 Workman St. (public garage)—complete equipment for 16 stall garage and minor repairs.

Que., Napierville—P. Rancourt—automobile repair equipment.

Que., North Hatley—Lake Side Garage, Ltd., F. W. Ayer, Purch. Agt.—garage and automobile repair equipment.

Que., Notre Dame de Stanbridge—J. Remillard—automobile repair shop equipment.

Que., Sawyerville—H. E. Hurley—garage and automobile repair equipment.

Que., Waterville—D. W. Ayer, Main St.—garage and repair shop equipment.

Machinery Wanted

Calif., Oakland—Elmhurst Press, 9633 East 14th St.—18 or 19 in. model bench paper cutter.

Calif., San Francisco—Amer. Can Co., Mills Bldg.—machinery and equipment for large addition to can factory at Honolulu, T. H.

Colo., Fort Collins—C. Preusch, 608 West Laurel St. (job printer)—pony press, power paper cutter and metal cutter (used).

Colo., Strasburg—News—cylinder press.

Ill., Chicago—Cruver Mfg. Co., 2456 West Jackson Blvd—Miehle 2 revolution job press; 2 roller pony press; Miehle job press, No. 2, 3 or 4 roller; 2 revolution cylinder press; belting.

Ill., Polo—Tri-County Press—newspaper equipment.

Ind., Sullivan—Bd. Educ.—manual training equipment for new $100,000 high school.

Kan., Elkhart—Morton County Progress—perforator and stapler.

Kan., Norwich—The Herald—12 x 18 in. power job press.

Kan., Oxford—Oxford Blacksmith Shop—forge, anvil, power drill press, emery wheel and stand.

Kan., Wichita—F. M. Adell, 316 North Fern St. (contractor)—power machine for making cement bricks, also pulleys, hangers, belting and shafting.

Kan., Winfield—Alexander Print Shop, Cowley County Bank Bldg.—power job press and Miller feeder (used).

Kan., Winfield — D. Cook, East 11 St. (woodwork)—Universal saw, power belt sander, power wood lathe, belting, hangers and shafting.

Kan., Winfield — T. E. Leftwich, 918 Litchfield St. (job printer)—job printing press, power paper cutter, belting, hangers and shafting.

Kan., Winfield—Spoon—Deck Printing Co., B. Deck, Purch. Agt.—job printing press and Miller feeder (used).

Ky., Princeton—Princeton Hosiery Mills—machinery for proposed $40,000 mill.

Mass., Boston—C. W. Hill, 123 Oliver St.—Spott & Butt welder (used).

Mass., Fall River—A. Legasse, 2147 Pleasant St.—bottle making machines, tank furnace and bottle molds for proposed glass factory.

Mich., Wayne—Arcadian Consolidated Mining Co.—hoisting machinery.

Minn., Red Lake Falls—L. Spillam—newspaper press, job press and other printing equipment.

Minn., Tracy—T. Jenson (general contractor)—one 1,800 lb. pile hammer and nippers (used).

Mo., Liberty—Central Oil & Gas Co.—complete machinery, pumps and equipment for proposed gasoline bulk distributing stations, here and at Henrietta.

N. H., Canaan—Reporter—Wing-Horton mailer.

N. J., Little Falls—Paramont Rubber Co., Consolidated—additional machinery, etc., for plant of Regal Tire & Rubber Co. at Sherbrooke, Que.

N. Y., Buffalo—Amer. Lithographic Co., 111 Swan St.—equipment for making lithographic typographic advertising matter, for proposed small plant on Amherst and Elmwood Aves.

N. Y., Buffalo—C. T. Macris, 121 Heath Ave.—additional machinery and equipment for candy factory at 120 Norwalk Ave.

N. Y., Buffalo—E. N. Mead, 618 Auburn Ave.—equipment for carpenter shop at 165 Marion St.

N. Y., Buffalo—H. J. Otten, 143 Burgard Pl.—equipment for sheet metal products shop.

N. Y., Jamestown — Jenkins-Carlson Printing Co., Arcade Bldg.—printing presses, transmission and conveying machinery, typesetters, etc., for proposed plant at 27 Market St.

N. Y., Jamestown—Union Furniture Co., 226 Crescent St.—additional machinery and equipment for dry kiln.

N. Y., Riverbank—Adirondak Enterprises, Inc.—6 column quarto press, newspaper folder and power paper cutter.

N. Y., Seneca Falls—Wescott Rule Co., 10 East Bayard St.—Colts Armory job press.

N. C., Mebane—The Enterprise—4 page, 6 column press and folder.

O., Cleveland—Cleveland Building Trades Employers Assn., W. P. Carroll, Mgr.—machinery, tools and equipment for carpenter school.

O., Columbus—Franklin Mill & Lumber Co., 375 Dennison Ave., J. S. Jones, Mgr.—one Universal woodworker, sander and mortiser.

O., South Euclid—Henry-Brass Co—machinery and equipment for the manufacture of baskets, to replace that which was destroyed by fire.

Pa., Butler—Record Printing Co.—power perforator.

Pa., Catasaqua—Davies & Thomas—one cupola for foundry.

Pa., New Castle—Consolidated Motors Co., c/o Bd. of Trade, W. O. Dayton, Vice Pres.—assembling machinery and equipment for proposed factory.

Pa., Pittsburgh—Standard Seamless Tube Co., Granite Bldg.—one 10 ton crane.

Pa., Scranton—H. G. Smith & Bro., 313 Vine St.—machinery and equipment for plant for the manufacture and repair of automobile bodies, etc.

Pa., Wilkes-Barre — Woodlawn Farm Dairy Co., North Washington and East North Sts.—dairy machinery and equipment.

Pa., Williamsport—Printer, 868 Rural Ave.—power job printing press, newspaper press, etc. (used preferred).

R. I., Providence—United Electric Rys. Co., 100 Fountain St., H. W. Sanborn, Ch. Engr.—automatic rail bender for heavy rails.

S. C., Columbia—Lorick & Lowrance, 1529 Main St.—sanding machine for flooring.

S. C., Edgefield—W. C. Thompson—complete machinery for the manufacture of sash cord.

S. C., Inman—Builders Supply Co.—automatic lathe for turning table legs.

Tex., Daingerfield—E. Scroggins—complete sawmill and planing mill equipment.

Tex., Dallas—Monte Caro, c/o E. C. Palmer & Co., 405 Lacy St.—newspaper press and job press.

Tex., DeKalb—A. W. Jolly, Box 172 (job printer)—8 x 12 power job printing press, 10 x 15 job press, pony cylinder, stitcher, perforator, punch press and printing equipment.

Tex., Rogers—F. Leahy (contractor)—Fairbanks hopper and seed scales.

Tex., San Antonio—V. E. Curtis, 206 Garden St.—job printing press, newspaper press, etc. (used preferred).

Va., Richmond—Auto Tire Co., 1905 East Main St. (tires and vulcanizing)—buffing machine.

Va., Richmond—Handley Service Sta., 630 North 2nd St.—tire changing machine.

Va., Richmond—H. H. Price, 112 East Jackson St. (newspaper and job printing)—power cutting knife for paper.

Va., Richmond—Store Fixture Exchange, 1823 East Main St.—combination woodworking machine.

Va., Richmond—Stuart Fonk Corp., 1606 West Main St.—air compressor.

Va., Wytheville—R. P. Johnson Co. (machinery dealer)—heavy planer for the manufacture of hardwood flooring.

Wis., Brokaw—Wausau Paper Mill Co., W. L. Edmonds, Mgr.—gate hoist and chains for lifting gates for dam.

Wis., Eau Claire—Lange Canning Co., Mill St.—conveyors for proposed $40,000 addition to cannery.

Wis., Highland—Williams Mining Co.—mill machinery, conveyors, belting and shafting for proposed plant for mining lead ore.

Wis., Kenosha—Nash Motors Co. (automobiles)—forge and small tools for proposed forge shop.

Wis., Madison—O. Lofstjordon, 802 Center Ave.—machinery and equipment, including mixers, conveyors, etc., for proposed cement block factory.

Wis., Milwaukee—Everwear Shoe Mfg. Co., 785 5th St., J. Lange, Purch. Agt.—lasting, vamping and siding machines.

Wis., Milwaukee—Millwork Supply Co., 326 Grand Ave., W. T. Roehring, Purch. Agt.—sanding machine and circle saw.

Wis., New London—Modern Mfg. Co.—belting, shafting, etc., for proposed $40,000 factory for the manufacture of women's wearing apparel.

Wis., Sheboygan—H. Davis, 722 Jefferson St.—large veneer press.

Wis., Silverlake—Riverview Fdry., R. M. Dixon, Genl. Mgr.—equipment for proposed $50,000 foundry, to replace that which was destroyed by fire.

Wis., Stevens Point—Stevens Point Brick Co., 426 Normal Ave.—brick making machinery and conveyors for proposed $40,000 plant, to replace that which was destroyed by fire.

Wis., Wausau—McEachron Apartment Co,. 812 Franklin St., H. E. McEachron, Pres.—laundry equipment, including dryers for proposed 50 x 100 ft. apartment building.

Wyo., Glenrock—C. L. Olmstead (cleaning plant)—30 x 30 reversible gear washing machine.

Ont., Glencoe—Glencoe Milling Co., C. Morrison, Dresden, Pres.—complete flour mill equipment.

Ont., Kitchener—P. Gies Fdry. Co., Ltd.—machinery, etc., for the manufacture of gasoline pumps and other specialties.

Ont., London—Box-Board Products, Ltd., 316 Rectory St., W. Nickle, Mgr.—special equipment for the manufacture of cardboard specialties, egg cases, etc.

Ont., London—United System Bakeries, 418 Richmond St.—electrical equipment for proposed branches.

Ont., Port Hope — Port Hope Sanitary Mfg. Co., Ltd.—smelter equipment.

Ont., Toronto—Ford Motor Co. of Canada, 672 Dupont St.—equipment, including furnaces, etc., for proposed $200,000 heat treating plant at Ford.

Ont., Toronto—J. Inglis & Co., Ltd., 14 Strachan Ave. (manufacturer of machinery)—electric traveling crane, sand mixing machinery, etc.

Ont., Trenton — Benedict & Practor—equipment for silver plating plant.

Que., Asbestos — E. Parenteau — equipment, etc., for wheelwright.

Que., Coaticook—D. S. Carou—additional equipment for blacksmith shop.

Que., D'Israeli—C. Octeau—additional equipment, including tools, forge, etc., for blacksmith shop.

Que., D'Israeli—Parent & Frere, A. Parent, Purch. Agt.—additional machinery for sash and door factory.

Que., East Angus—A. Champort (garage)—additional repair equipment.

Que., Frelighsburg—C. Van Antwerp—blacksmith shop equipment.

Que., Gould—R. Morrison (garage)—repair equipment.

Que., Gould—E. Rousseau (blacksmith)—additional forge and other equipment.

Que., Inverness—E. McCrae (saw mill)—additional saw mill equipment.

Que., Inverness—J. A. Precourt (saw mill)—additional equipment, including saws, etc.

Que., La Patrie — V. Drolet—machinery for sawmill, including bandsaw.

Que., La Presentation—W. Menard—additional bandsaw and other sawmill equipment.

Que., Louisville — A. Desrosier — additional equipment for sash and door factory.

Que., Montreal—Cld Electric Heater Co., Ltd., c/o F. J. Laverty, 189 St. James St.—equipment for the manufacture of electrical apparatus.

Que., Phillipsburg—Wallace Sandstone Quarries, Ltd., F. S. Allen, Purch. Agt.—additional quarrying and cutting machinery.

Que., Plessisville — J. Noel—forge and other equipment for blacksmith shop.

Que., Richmond — R. E. McArthur—equipment for blacksmith shop.

Que., Rockburn — W. Gibson—additional sawmill equipment.

Metal Working Shops

California and Oregon—L. R. Lurie, 315 Montgomery St., San Francisco, plans to build automobile stage terminals at various points, here. Estimated cost of complete series will exceed $1,000,000. Pickwick Corp., 683 Market St., San Francisco, lessee.

Calif., Long Beach — The Pacific Steel Corp. plans to build a rolling mill on a 200 acre site, here. Cost will exceed $10,000,000. D. M. Reynolds, 1st Natl. Bank, 707 South Spring St., interested.

Calif., San Francisco — L. Barrett, 415 Taylor St., awarded the contract for the construction of a 2 story garage on O'Farrell St. near Taylor St. Estimated cost $75,000.

Conn., Hartford—A. Goldstein, 226 Bellevue St., is having plans prepared for the construction of a 1 story, 80 x 207 ft. garage on Windsor St. Estimated cost $50,000. Private plans.

Conn., Oakville—The Oakville Co., manufacturer of brass, is having plans prepared for the construction of a 2 story, 70 x 120 ft. factory. Estimated cost $40,000. Lockwood, Greene & Co., 24 Federal St., Boston, Engrs. and Archts.

Conn., West Hartford (Hartford P. O.)—Cohn & Feinsilber, Prospect Garage, are receiving bids for the construction of a 1 story, 100 x 100 ft. addition to its garage on Prospect Ave. Estimated cost $40,000. B. A. Sellew, 721 Main St., Archt. Noted July 5.

D. C., Wash.—T. M. Medford, Archt., 1631 3rd St., N. W., is preparing plans and will receive bids about Aug. 1 for the construction of a garage and warehouse on 1st St. near L. St., N. E., for W. F. Nash, 120 M St., N. W. Estimated cost $100,000.

Ill., Chicago—The Chicago Steel & Wire Co., 103rd and Torrence Sts., is having plans prepared for the construction of a 1 story, 193 x 300 ft. factory to be erected in three units. Estimated cost $500,000. L. G. Hallberg & Co., 116 South Michigan Ave., Chicago, Archts.

Ky., Cynthiana — C. LeBus is haying plans prepared for the construction of a 1 story, 90 x 200 ft. garage. Estimated cost $40,000. Manley & Young, 814 West Hill Ave., Knoxville, Tenn., Archts.

Ky., Louisville—R. Rosa, c/o Amer. Mosaic & Tile Co., 309 East Bway, is having plans prepared for the construction of a 2 story garage. Estimated cost $75,000. Joseph & Joseph, Francis Bldg., Louisville, Archts.

Ky., Middlesboro—The Motch Motor Co. plans to build a 2 story, 50 x 180 ft. garage and machine shop. Estimated cost $50,000.

La., Shreveport — The Kansas City Southern R.R. is having plans prepared for the construction of a 2 story, 85 x 500 ft. car shops, to replace the one which was destroyed by fire. Estimated cost $100,000. O. E. Stump, Shreveport, Traveling Engr.

Me., Portland — The Portland-Nash Co. awarded the contract for the construction of a 3 story, 120 x 140 ft. garage and machine shop. Estimated cost $175,000, including machinery. Noted Apr. 19.

Md., Baltimore—Flynn & Emrich, 305 North Holliday St., are having plans prepared for the construction of a foundry, machine, casting and storage building, also boiler house. Estimated cost $75,000. Private plans.

Mass., Boston — The city, City Hall, awarded the contract for the construction of a 2 story, 125 x 200 ft. garage on Albany St. Estimated cost $152,490. Noted June 21.

Mass., Brighton (Boston P. O.)—The Corey Rd. Garage, Inc., 112 Corey Rd., is having sketches prepared for the construction of a 2 story, 106 x 300 ft. garage. J. H. Bickford Co., 6 Beacon St., Boston, Archt.

Mass., Pittsfield — Smith & McCarthy (Ford Agency) are having plans prepared for the construction of a 3 story, 35 x 60 ft. garage. Estimated cost $44,000. G. F. Haynes, 184 North St., Pittsfield, Archt.

Mass., Worcester—The Amer. Steel & Wire Co., Grove St., will open bids in the fall for the construction of a 1 story, 55 x 100 ft. and 20 x 30 ft. annealing plant. Estimated cost $150,000, including equipment. Private plans.

Mo., Kansas City—The Federal Bldg. & Loan Assn., 531 Scarritt Bldg., is having plans prepared for the construction of a 3 story, 96 x 115 ft. garage on 9th and McGee Sts. Estimated cost $75,000. Private plans. H. A. Rubin, 1333 Grand Ave., Lessee.

N. Y., Brooklyn—The Aaron Constr. Co., c/o A. Goldberg, Engr. and Archt., 164 Montague St., will build a 1 story garage on Empire Blvd. Estimated cost $85,000.

N. Y., Buffalo—S. Landt, 494 Elmwood Ave., plans to build a 1 story, 33 x 85 ft. garage and service station. Estimated cost $40,000. Engineer or architect not announced.

N. Y., Buffalo—W. Rixey, 1146 Niagara St., plans to build a garage and repair shop. Estimated cost $40,000. Engineer or architect not selected.

N. Y., Cape Vincent—The Northern Oil & Fuel Corp., Coffeen St., Watertown, has purchased site and plans to build a garage, machine shop, repair and service station on Main St., here. Cost between $20,000 and $25,000. G. W. Lane, Pres.

N. Y., Dansville—The Macomber Garage, Inc., plans to build a garage and repair shop on Ossian St. Estimated cost $40,000. Engineer or architect not announced.

N. Y., Oswego—The state is having plans prepared for the construction of a machine shop in connection with grain elevator, here. State Canal Bd., Albany, Archts.

O., Cleveland Heights (Warrensville P. O.) — Thorsell Bros., Mayfield Rd., have had plans prepared for the construction of a 1 story, 50 x 110 ft. garage. Estimated cost $40,000. H. L. Shupe, 12429 Cedar Ave., Cleveland, Archt.

Ore., Oakridge—G. H. Kelly, Spaulding Bldg., Portland, is having plans prepared for the development of a town site, including saw and planing mill, machine shop, etc., near here. Estimated cost $2,000,000. W. J. Morris, Spaulding Bldg., Portland, Engr.

Pa., Bellefonte—Decker Bros., North Spring St., Chevrolet agents, plan to build a 3 story, 90 x 120 ft. garage, automobile repair shop and supply station on High and Spring Sts. Estimated cost $75,000. M. Decker, Pres. Engineer or architect not selected.

Pa., McKeesport—H. W. Waldbaum, 6th and Walnut Sts., will build a 4 story, 60 x 140 ft. garage. Estimated cost $50,000.

Pa., New Castle — The Consolidated Motors Co., c/o Bd. of Trade, manufacturer of taxicabs, plans to build an assembling plant. Cost will exceed $50,000. W. O. Dayton, Vice-Pres. Engineer or architect not selected.

Pa., Scottdale—The United States Cast Iron Pipe & Fdry. Co., Burlington, N. J., awarded the contract for the construction of a 1 story, 106 x 263 ft. factory, here. Estimated cost $55,000.

Pa., Scranton—A. Anderson, 409 Adams Ave., awarded the contract for the construction of a 1 story, 40 x 160 ft. garage, salesroom and service station. Estimated cost $40,000.

Pa., Sharpsburg — The Natl. Engine & Machine Co. plans to build an addition to its factory. Estimated cost $50,000. Engineer or architect not announced.

R. I., Providence—E. Radding, 144 Westminster St., awarded the contract for the construction of a garage and service station on North Main, Frost and Nashua Sts. Estimated cost $75,000. Noted May 24.

Tenn., Memphis—J. E. Stark & Co., Plum St., plan to build a 64 x 85 ft. planing mill with machine shop addition.

Tex., Dallas—The Bolanz Investment Co., c/o Murphy & Bolanz, Commerce St., plans to rebuild the 2 story factory on Commerce and Dove Sts., which was destroyed by fire. Estimated cost $75,000. Engineer or architect not selected. Texas Wheel & Body Co., Commerce and Dove Sts., lessee.

W. Va., Beckley—W. C. Agee will build a 2 story, 50 x 115 ft. garage. Estimated cost $40,000.

W. Va., Williamson—S. M. Goodloe is having plans prepared for the construction of a 3 story, 50 x 100 ft. garage. Estimated cost $40,000. D. M. Good, Williamson, Archt.

Wis., Appleton—The Northern Boiler & Structural Iron Co., Mill St., will build a 1 story, 60 x 100 boiler shop. Estimated cost $40,000.

Wis., Cambridge—A. Kravick will build a 1 story, 50 x 95 ft. garage and filling station. Estimated cost $40,000. Noted Dec. 21, 1922.

Wis., Fond du Lac—J. Grebe, 22 Rees St., awarded the contract for the construction of a 1 story, 56 x 106 ft. garage and repair shop. Noted July 5.

Wis., Fond du Lac—H. W. Voell, 59 North Main St., is having plans prepared for the construction of a 1 story, 50 x 60 ft. garage and repair shop. Estimated cost $40,000. Private plans.

Wis., Green Bay—The Beaumont Hotel Co., West Main and Washington Sts., awarded the contract for the construction of a 1 and 2 story, 60 x 160 ft. garage. Estimated cost $40,000. Noted July 5.

Wis., Green Bay—The Green Bay Motor Car Co., 316 North Jefferson St., plans to build a 2 story garage on Main St. Estimated cost $50,000. Engineer or architect not selected.

Wis., Madison—W. Brueski, 2805 East Washington Ave., will build a 2 story, 50 x 90 ft. garage and repair shop. Estimated cost $40,000. Noted July 5.

Wis., Milwaukee—The Curtis Auto Co., 143 8th St., is having plans prepared for the construction of a 3 story, 100 x 127 ft. garage on Bway. Estimated cost $200,000. Federal Eng. Co., 444 Milwaukee St., Engrs.

Wis., Milwaukee—The International Harvester Co., 217 Oregon St., is having plans prepared for the construction of a 4 story, 100 x 148 ft. assembling plant and warehouse on Reed St. Owner's Architectural Dept., 606 South Michigan Ave., Chicago, Archts.

Wis., Milwaukee—The Sinclair Refining Co., 425 East Water St., will build a service and filling station, including a 40 x 60 ft. main building and a 20 x 20 ft. pump house. Estimated cost $40,000.

Wis., Neenah—H. and W. Niles, c/o Neenah Boat Wks., plans to build a 2 story addition to boat factory. Estimated cost $50,000. Engineer or architect not selected.

Wis., Port Washington—Schmidt Bros. awarded the contract for the construction of a 2 story, 50 x 100 ft. addition to garage. Estimated cost $40,000. Noted June 14.

Wis., Prairie du Sac—J. U. Schmidt is having plans prepared for the construction of a 1 story, 50 x 90 ft. garage and repair shop on Galena St. Estimated cost $40,000. Private plans.

Wis., Rice Lake—The C. O. Ronning Co. awarded the contract for the construction of a 2 story, 50 x 160 ft. garage. Estimated cost $60,000.

Wis., Shawano—J. Popp is receiving bids for the construction of a 2 story, 40 x 48 ft. garage and repair shop. Estimated cost $40,000. Private plans. Noted Apr. 26.

Wis., Silverlake — The Riverview Fdry. plans to rebuild its 1 story foundry, which was destroyed by fire. Estimated cost $50,000. R. M. Dixon, Genl. Mgr. Engineer or architect not selected.

Wis., Waterloo—Lazers & Sons Motor Co., Marshall, will build a 2 story, 45 x 80 ft. garage, here. Estimated cost $40,000.

Ont., Ford — The Ford Motor Co. of Canada, 672 Dupont St., Toronto, is having plans prepared for the construction of a 1 or 2 story heat treating plant here. Estimated cost $200,000. A. Kahn, Marquette Bldg., Detroit, Mich., Archt.

Ont., Weston—The Brooks Steam Motors, Ltd., 1304 Canadian Pacific R.R. Bldg., Toronto, plans to build an automobile factory here. Estimated cost $500,000. Engineer or architect not selected.

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